UNIV. OF MICHIGAN
MAY 1 1951
EAST ENGINEERING
LIBRARY

A view of a section of the Bound Brook, New Jersey plant of Bakelite Company, a Division of Union Carbide and Carbon Corporation.

PUBLISHED BY THE SOCIETY OF PLASTICS ENGINEERS, INC.

What's New?

Equipment

LIQUID BLAST CLEANING

A new midget unit by Pangborn Corporation for liquid blast cleaning, called the Number 6 Type EZ Hydro-Finish Blast Cabinet uses the same wide range of abrasives (as fine as 5000 mesh) as its larger brothers, can hold tolerances on blasted parts to within 0.0001 of an inch, requires 17" x 22½" of floor space and only 110 volt AC to drive its filter and dust bag motor, operates from either a ¼" compressed air line or any bottled gas, has a blast chamber fifteen inches in diameter with a light, right and left hand holes and an observation window. For complete details contact Pangborn Corporation, Hagerstown, Md.

TEMPERATURE CONTROL

Improved Paper Machinery Corporation has introduced a new mold temperature control unit. It is known as Model #3 Impco Temperature Controller. It has a capacity of 15 gallons with a circulating pump of 35 GPM at 26' head. Temperature is controlled by means of two 3000 watt heating elements and a multipass heat exchanger, water-cooled. Temperature may be held to within 2°F. working temperature range being from 70°F. to 250°F. Complete details can be obtained from Improved Paper Machinery Corporation, Nashua, N. H.

DRILL JIG

During the last war, the University Tool Company started the manufacture of Parlec Drill Jigs. This ingenious basic drill jig enabled the toolmaker or driller to simply machine the base of the jig for properly locating the part to be drilled, cut holes in the cover and insert the bushings to complete the jig required. The unit was sturdily constructed of nickle iron and normalized with top, bottom and both sides of jig frame and cover finished.

The Parlec Box Drill Jig is now available for immediate delivery in five standard sizes: one and one-half inch by two inch, three inch by three and one-half inch, three and one-half inch by five and three-quarters inch, six inch by six inch and one and one-half inch by six inch. Jigs with special sizes for covers and special heights are furnished on order. Master layouts are supplied at no additional cost.

Universal is also marketing a drill jig for round stock. This adjustable round stock drill jig comes in three sizes that will handle from one-quarter inch to two inch stock.

Complete price lists and descriptive literature for both the Parlec Box Drill Jigs and the Parlec Drill Jigs for Round Stock are available from Franklin E. Smith & Associates, National Sales Agents, 6201 Carmelita Avenue, Bell, California.

HAND HEAT SEALER

Sealine Manufacturing Corporation announces an entirely new method of heat-sealing directly on polyethylene, pliofilm and other thermo-plastic films. The new "Sealine" 50 hand sealer, with 2½" dia. free-rolling heated wheel, is ideal for sealing odd shaped objects as well as for end-sealing of bags. The wheel design makes it possible to get over and around areas heretofore untouchable with a sealer.

A variety of wheels for different applications may be obtained with "Sealine" 50. These applications include sealing cellophane bag ends, butt-sealing thin vinyls and to cut and seal other films.

Weight is less than 1 lb. A large and comfortable grip makes it easy to handle. Safety rest keeps roller off table or bench when not in use.

The "Sealine" 50 makes use of a special fluid which is automatically fed to the heated wheel through a wick arrangement. A few drops are sufficient for many hours of sealing.

Temperature is adjustable, convenient and accurate from 200° to 450°F. Heating element uses only 50 watts. Operates on either AC or DC current.

Full details may be had by writing to the manufacturer, Sealine Manufacturing Corp., 170 N. Peoria St., Chicago 7, Ill.

TENSION CONTROL

A new idea from the aluminum foil industry should be useful to plastic sheeting manufacturers. The fields have at least one processing difficulty in common: the handling of delicate, extremely thin sheet materials.

The problem of strip breakage and tearing has been solved by the aluminum foil people with a new tensioning setup for mills. Aluminum foil is rolled down to .0003" thickness and even thinner. The problem was to feed the aluminum from coils into the rolls of the mill at a tension which would keep it from wrinkling and at the same time not tear the delicate foil ribbon. Tearing of the foil meant not only considerable scrap, but a time-consuming job of clearing and re-threading the machines.

The new tensioning control is based on use of a novel high capacity low pressure air brake manufactured by Linderman Devices, Newburgh, New York. Tension produced by this brake can be precisely calibrated against air pressure and controlled by an air valve. No separate air supply is required—ordinary factory line compressed air being adequate.

The problem of changing tension requirements as the coil is dereeled is taken care of by the operator who simply adjusts the air pressure to the brake according to a calibration chart.

COOLING UNIT

An industrial water or brine cooling unit as complete as a household appliance was recently announced by Mayer Refrigeration Engineers, Inc. of Rutherford, New Jersey. The new unit is entirely self-contained and ready for operation when connected to water and power lines. One push button controls a continuous, automatic supply of recirculated chilled water or brine at the temperature and volume required.

The unit, designed for heavy duty cooling, includes a high head, high volume water circulating pump, storage tank and complete auxiliary equipment assembled on permanent steel skids that eliminate the necessity of any foundation or bolting down. It is compact enough to clear through standard doors and can be easily re-located and used for other cooling requirements.

The unit operates on either gravity or pressure water return without an additional pump and automatically adjusts to variable load and flow. The temperature range is adjustable. The units are manufactured in eight sizes with refrigerating capacities ranging from 3 to 150 tons.

PREBREAKER

To meet the growing industrial demands for plastic-reducing machines with larger throat openings, Cumberland Engineering Company, Inc., Providence, R. I., has developed two new prebreakers, Models 24 and 32.

The larger prebreaking machine (Model 32) has the largest throat opening available on any machine of this type today—an opening of 20" x 32"! The smaller prebreaker features a 10" x 24" throat opening.

These large throat openings enable the machines to cut up or break bulky plastic parts which are too large to feed directly into granulating machines. Plastic material as large as radio, television cabinets and plastic tote boxes can be fed into the machine, which breaks or cuts the material depending on whether it is brittle or non-brittle. The small plastic pieces produced from these machines can be fed directly into Cumberland granulating machines for faster, more efficient and economical granulation.

Both Cumberland Prebreakers are extremely rugged and feature an all-steel construction. Each machine contains one stationary knife, 2 rotating knives and a screen with large holes underneath the rotor. Like all Cumberland machines, the new prebreakers are designed for quick and easy cleaning.

For more information, write Cumberland Engineering Co., Dept. 4N, Box 216, Providence, R. I.

MIXER

L. O. Koven & Brothers, Inc., Jersey City, N. J., has produced a new heavy duty A.S.M.E. mixer for processing and blending viscous compounds, such as plastic compounds, heavy chemical solutions, solids suspended in heavy liquid vehicle, and the like.

The 36" diameter mixer is welded in accordance with Paragraph U-69, A.S.M.E. Code, for vacuum operation. A full steam jacket is provided for heating the product during the mixing process. The cover which is gasketed and bolted to the tank is provided with an 11" x 15" hinged manhole and a 4" sightglass. The outlet valve is located on the bottom of the tank. A thermowell projects into the side of the tank near the bottom.

An 18" diameter turbine type impeller is driven at approximately 125 r.p.m., by a 5 h.p. explosion-proof motor through a speed reducer. To augment the impeller, three baffles have been equally spaced in the tank, projecting radially along the cylinder but mounted one inch away from the cylinder wall.

The rotation of the turbine, because of the pitch of its blades, gives the material a combined peripheral and upward motion. As some of the material strikes the baffles it is turned back to give it an extra rotary kneading or turn-over action. At the same time some of the material flows between the baffle and the cylinder wall which gives it a shearing effect. Thus, the entire mass goes through a continuous suction, dispersion, kneading and shearing cycle which rapidly disintegrates and distributes uniformly and intimately any solids in the vehicle or homogeneously mixes fluids of dissimilar specific gravity and viscosity.

Literature

TAYLOR LAMINATES

Taylor Fibre Co., manufacturers of Vulcanized Fibre, Phenol Fibre and Special Glass Melamine and Silicone Laminates, announces publication of its new 1951 catalog entitled, "TAYLOR LAMINATED PLASTICS."

This 62-page catalog, which is divided into four main sections, covers vulcanized fibre, phenol fibre and special laminates, design and machining hints, and Taylor engineering and research facilities. Charts and tables of engineering data are included. The main objective has been to build a catalog which covers basic engineering data on Taylor products, so that the user, whether a design engineer, production engineer or buyer of these versatile products can readily find the best material suited to his specific application.

Taylor Fibre Co. will be pleased to send a free copy of the TAYLOR LAMINATED PLASTICS catalog to anyone requesting it. Letters should be directed to the company's main office—Norristown, Pa.

METALLIC SOAPS

The applications of Whittaker Metallic Soaps (Stearates), aluminum, barium, calcium, magnesium, zinc, and zinc palmitate are completely described in this new booklet now being distributed by Whittaker, Clark & Daniels, Inc., 260 West Broadway, New York 13, New York. Tables show the analysis, physical properties and solubility of each product. For those who use metallic soaps, this book contains all the necessary information for selecting the proper product.

Distribution is free but is restricted to industrial manufacturers.

TUMB-L-MATIC

A new bulletin on the Tumb-L-Matic process has been released by Tumb-L-Matic, Inc., New York. The bulletin describes the latest methods for cutting down, deburring, defining, dry burnishing and polishing metal and plastic parts. Bulletin No. LS-50 describes the complete line of Type LS (single tumbler) equipment. Also included are descriptions of drives, sizes, controls and liners. Tumb-L-Matic's specific process is discussed to some extent. It consists of recommending the correct type of barrel and correct barrel speed, and the right compound or media. The compound can range in grades of abrasives and may be used with various ratios of chips or pegs, depending upon product to be finished. Copies available on request. Write to Tumb-L-Matic, Inc., 4510 Bullard Avenue, New York 70, N. Y.

NEW POWER TOOL

A new production hand tool called the "Hi-Power Grinder" is described in a 4-page folder just published by Chicago Wheel & Mfg. Co., 1101 West Monroe Street, Chicago 7, Illinois. The folder is fully illustrated, outlines the advantages and exclusive features found in the tool, and shows its applications in the industrial field.

PATTERSON AT EXPOSITION

The Patterson Foundry & Machine Company of East Liverpool, Ohio, had space at the International Industrial Exposition, March 11 through 17, in the Houston Coliseum, Houston, Texas. As part of the only technical, mechanical, and engineering Exposition in the entire southwest, the Company's display exhibited Patterson's wide range of grinding, mixing, blending, and separating machinery.

(Continued on page 17)

JOURNAL

Vol. 7 No. 4 April, 1951

Published monthly except July and August by the

SOCIETY OF PLASTICS ENGINEERS, INC.
409 SECURITY BANK BLDG.
ATHENS, OHIO

Dr. Jesse H. Day, *Editor*

Editorial Advisory Board: MARIO PETRETTI, J. H. DUBOIS, WAYNE PRIBBLE, CARL J. FROSCH

Advertising Representatives: Ortgies & Dillon, 155 East 44th St., New York 17, N. Y.

30 cents a copy **$3.00 a year**

Entered as second-class matter at the Post Office at Athens, Ohio.

Copyright 1951 by the Society of Plastics Engineers, Inc.

INDEX

ARTICLES

Vacuum Molding of Plastics—By Walter R. Kosy 5

The Elevated Temperature Creep and Fatigue Properties of a Polyester Glass Fabric Laminate By W. N. Finley and W. J. Worley 9

FEATURES

What's New 2

President's Corner 3

Questions and Answers 4

Injection Molderscope 8

SECTION NEWS

Chicago 20; Detroit 4; Golden Gate 19; Miami Valley 18; Newark 18; New York 18; Toronto 19; Upper Midwest 19.

Section Notes 20

ADVERTISERS

Bakelite Div., Union Carbide & Carbon Corp. 7

Ball and Jewell, Inc. 19

Barrier-Pribble & Co. Inc. 14

Injection Molders Supply Co. 4

Manco Products Co. 20

Miskella Infra-Red Co. 18

The Society of Plastics Engineers Journal is not responsible for the views expressed by individual contributors. Copy for each issue should be received at 409 Security Bank Bldg., Athens, Ohio, before the fifth of each month.

The President's Corner

If any of our members are contemplating a trip to England during the month of June, they should be sure to visit the British Plastics Exhibition and Convention to be in Olympia, London from June 6 to June 16, 1951.

Your President is very happy to report that we have had many favorable comments on the February issue of SPE JOURNAL.

Ed Rowan has accepted the position as National Chairman of the Speakers Committee. All Program Chairmen will be hearing from him shortly.

All Committee Chairmen for the 1952 SPE Conference have been appointed. Mr. John T. Bent, General Chairman of the Executive Committee reports that work is already underway for this 1952 Conference which will be held in Chicago next January.

Some of our very good members have overlooked payment of dues for the period of 1950-51. Please see that you are not one of those who have forgotten to send in their dues.

Islyn Thomas

Islyn Thomas
National President

Section Transfer

From time to time the section secretary is confronted with the problem of what to do about a member who has moved out of the area served by his section without requesting a transfer.

Article II, Part 1 B 2a, "Any member may or may not be affiliated with any geographical Section of the Society in accordance with his convenience and desires."

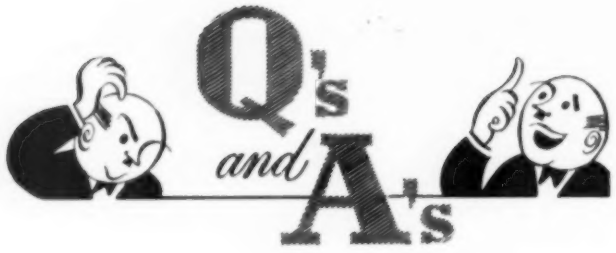
There is not much the local secretary can do unless the member has requested a transfer. He should notify the National Office that the member has moved out of the area, giving the member's new address if he has it. The National Office will then contact the member giving the address of the section nearest him and ask him if he would like to transfer. If he does the National Office will handle the details.

However, any member in any class may transfer his Section affiliation at any time by a written notice to the Secretary of the Section with which he is affiliated and the latter shall notify the National Office and the Secretary with which affiliation is desired. All of the member's records should be sent to the Secretary of the new Section. A form to aid in the transfer of members is available in the National Office upon request.

Any transfer shall become effective at the beginning of the next quarter of the calendar year after notice has been given by the member. In the event of transfer the Section share of the member's dues for the year in which the transfer is made shall be divided between the two Sections according to the quarters of the calendar year in which the member was affiliated with each.

Complete instruction on handling the transfer of a member are contained in the Manual for Section Secretaries, which each section secretary has.

Notice—National Council meeting May 9, 1951 at the Builder's Club, Chicago. Be sure **your** Section is represented.



Q:

Gentlemen:

We have read an article in the November 4, 1946 issue of the periodical American Machinist entitled "Plastics Centrifugally Cast".

We are interested in getting some information on the number of manufacturers, their names and addresses also, who are using this type of installation.

We would also like to get some particulars on this type of plastic machinery.

Thanking you for any assistance which you may be able to give us on this matter.

A:

The Bakelite Division of Union Carbide and Carbon Corporation have been doing work on centrifugally cast plastics and will be able to assist you.

Q:

Gentlemen:

Not long ago, I read an announcement in one of the papers that some one has developed an attachment for injection machines so that thermosetting materials can be molded on same. Can you help me out with the name of the company that has developed it?

If you are not familiar with the above announcement, do you know the present status of jet molding?

Your kind reply will be greatly appreciated.

A:

The process was developed and patented by C. D. Shaw. The patents are held in trust by W. B. Hoey and E. D. McCauley. Plastic Processing, Inc., Flint, Mich., is sale licensing agent. They will give the information you desire.

And see also the "Injection Molderscope" feature of the next issue of the SPE Journal!

A:

Answer to last months question of a substitute for aluminum tubing. The Molded Fibre Co. suggests a fiberglas reinforced polyester resin sheet stock.

POSITIONS OPEN

Plastics Chemist—familiar with all phases of vinyl formulating and development. Thorough knowledge of processing techniques required. Terriffic opportunity with a progressive organization on Middle Atlantic seaboard. All information held in confidence. Reply in detail to Box IJ, SPE Journal, 409 Security Bank Bldg., Athens, Ohio.

Injection Molding Foreman—Large and well established company opening new plant in Sturgis, Michigan requires experienced injection molding foreman. Excellent future offered. Give experience and qualifications in reply to Box 2J SPE Journal, 409 Security Bank Bldg., Athens, Ohio.

Klippings From Kosy

By Walter Kosy

The March meeting of the Detroit Section of the SPE was held at the Rackham Memorial Building. Frank Donahue of the Monsanto Chemical Company spoke on the subject of phenolic molding.

He outlined the problems that have presented themselves with the advent of large moldings, such as the current television cabinets. The most important of these problems, according to Mr. Donahue, have been: (1) plastic flow, (2) mold release, (3) molded appearance, and (4) strength.

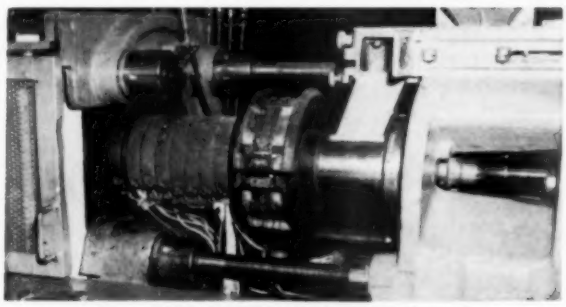
Problems of plastic flow have been met with new phenolic materials that flow rapidly, complete their flow in a short time, and then set hard. Mold release problems have been minimized by suitable compounding of the materials and by proper mold design. Appearance difficulties may be due to material properties or to features of the cabinet design. They likewise can be minimized by proper material compounding and proper mold design.

Strength in television cabinets is important because: (1) television sets are expensive and the purchaser expects full value for his outlay, including a cabinet that will withstand all reasonable normal usuage, (2) television assemblies are heavy and the cabinets have to meet severe handling conditions, and (3) the danger of electrical shock due to the high voltages in TV sets, should a cabinet break.

Proper strength in these cabinets can be provided for by following correct design practice.

(Continued on page 17)

INJECTION MOLDERS
***Know That* PERFORMANCE**
***Sells the IMS* SUPERHEATER**



8 oz. REED-PRENTICE CONVERTED TO
(Guaranteed) — **12 oz. (STYRENE)** — *(Pat. Pend.)*
WITH IMS REPLACEMENT SUPERHEATER

Users Report . . .
NOMA ELECTRIC: 323 gms.—55 shots per hour!
MICHIGAN PLASTICS: 325 gms. — 50 shots per hour!

Make Your 8-oz. Equal the 12-oz.
IMS 12 oz. Superheater for Reed 8's $975.
Send for Users List and Special Bulletin

Injection Molders Supply Co.
Penton Bldg. Cleveland 13, Ohio

Vacuum Molding of Plastics

By Walter Kosy

Chrysler Corp.

The vacuum shaping of plastics makes an excellent and inexpensive hobby. A simple and ingenious set-up is described.

Basement craftsmen who enjoy working with plastics can enlarge their scope of operations by using a relatively simple vacuum technique for molding articles from sheet plastic. Similar methods have been in use for some time in the production of plastic airplane cockpit enclosures and bombardier noses on military aircraft and these methods are readily adaptable to the home workshop.

Briefly, the method involves the drawing of heated plastic sheets into hollow plaster dies by means of a vacuum. The apparatus for creating the vacuum is probably the most expensive part of the whole set-up but it need not run over fifteen dollars. You will need an aspirator, which is a gadget that fastens on to your water faucet and acts as a little vacuum pump. It can be obtained from any scientific supply house for about a dollar.

Next you will need a small tank which serves as a vacuum reservoir. It should be air tight and large enough to hold a cubic foot or two of air. The tank shown in the photograph Figure 1, is an air surge tank from a metal stamping press which was salvaged from the junk heap, but any airtight tank will do. The surplus oxygen cylinders used by pilots during the war for breathing oxygen make excellent vacuum reservoir tanks and are readily obtainable at most war-surplus stores.

Remove the plug from one end of the cylinder and screw in a short length of ¼" pipe. Slip a short length of rubber tubing over the pipe and connect it to the exhaust nipple of the aspirator. The rubber tubing should be of the extra heavy wall variety with a ¼" bore and made to withstand a vacuum of 30 inches of mercury without collapsing. This is available from laboratory supply houses for about 25 cents a foot.

Similarly on the other end of the oxygen cylinder, remove the plug and screw in a short length of pipe. Attach a quick opening air valve and then by means of more rubber tubing connect it to the plaster mold.

It is desirable to have a vacuum gage attached to the vacuum reservoir tank. This may be put directly in the line between the quick opening valve and the tank. It will enable you to determine when the reservoir has built up sufficient vacuum to make a satisfactory draw and will detect any leaks in the system.

Walter Kosy

Molds for making the plastic articles are made of plaster-of-paris which costs only a few cents a pound. The United States Gypsum Company puts out a specially formulated plaster known as Hydrocal B-11 that is stronger and harder than ordinary plaster of paris. Molds made of this material will last a good deal longer than those of ordinary plaster-of-paris and the Hydrocal B-11 is easier to work with.

Fig. 1. This is the complete apparatus ready to go to work.

Each mold is made up in two parts: the mold cavity block itself and the hollow vacuum chamber block which goes under the mold cavity. Figure 2 is a picture of the vacuum chamber block (left) and the mold cavity block (right). The mold cavity block is placed on top of the vacuum chamber block and the two are sealed together resulting in the finished plaster mold.

To construct a mold, secure two cardboard boxes of about the same size and each large enough to contain the object which is to be drawn out of plastic. The object which is to serve as the pattern can be of almost any material; wood, steel, plaster, clay, and the like may be used. Since the plaster will be poured around the pattern and later removed, the pattern can have no undercuts which will prevent it from being withdrawn from the plaster after it hardens. Objects which are excessively tall in relation to their cross-sectional area are also undesirable, since the vacuum drawing operation will thin the plastic down excessively and may even cause it to rupture.

Parting Agent

The application of a coat of vaseline or hospital soap over the pattern serves as a parting agent and enables the pattern to be easily withdrawn after the plaster hardens.

The pattern is placed in the bottom of one of the boxes and located in the center so that there is plenty of room all around. The plaster, which has been prepared as a thin slurry is then poured over the pattern so that it covers it completely by a depth of about half an inch. Gently tap the sides and corners of the box for a few minutes with a stick so that air bubbles trapped in the plaster or adhering to the surface of the pattern will be jarred loose and rise to the surface.

Allow the plaster to harden for several hours before attempting to remove the pattern as the wet plaster is not very strong.

A few words on mixing the plaster may not be out of place. To prepare the plaster for pouring, secure a receptacle having a volume twice as large as the volume of the finished

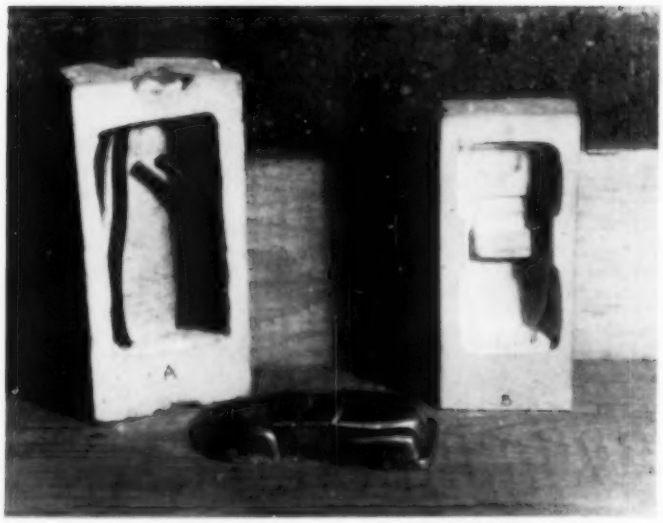


Fig. 2. Vacuum Chamber Block is at the Left, Mold Cavity Block at the Right.

mold and pour in enough water to equal the volume of the mold. Slowly sift the plaster into the water where it will sink to the bottom. When enough plaster has been added so that some dry plaster begins to show on the surface of the water, stir the plaster and water thoroughly with a stick to break up all the lumps. The plaster is now ready to be used to make the mold. It should be of about the consistency of buttermilk. Do not let it stand more than a few minutes as it will start to set in a short time.

After the mold cavity block is made, the vacuum chamber block is prepared in the same way except that the pattern in this case is a block of wax

Fig. 3. Pouring the Mold Cavity Block

or clay about an inch thick with a cross-sectional area slightly larger than the object which you are desirous of making. Bend a short length of ¼" copper tubing into a "J" shape and bury it in the wax or clay, so that the long end of the "J" projects on one side and loop of the "J" on the other side.

Place the wax or clay pattern in the other cardboard box with the end of the copper tubing projecting through the side of the box so that the plaster will not run into it. Pour the plaster slurry over it to cover it completely to a depth of about half an inch and let it stand several hours to harden.

When the plaster has hardened, tear away the cardboard from the mold blocks and level up the top and bottom surfaces so that they are flat by rubbing them over a sheet of coarse emery cloth. Scoop out the wax or clay from the vacuum chamber block leaving the ¼" tubing buried in the plaster. Make sure that the tubing is not plugged by blowing in one end.

To make the finished mold, place the mold cavity block on top of the vacuum chamber block and place the two blocks in the center of a larger cardboard box which is sufficiently deep to cover both blocks as they stand, one on top of the other. Again make sure that the copper tubing projects outside of the box so that it will not get plugged by plaster. Now pour the plaster slurry around the outside of the blocks, filling the cardboard box to a level even with the top of the mold cavity block (see Figure 3).

After the plaster has hardened your mold is almost complete. Tear away the cardboard box and level up the top surface of the mold with emery cloth. Pull out the pattern gently so as not to break the plaster mold cavity. A perfect reproduction of the pattern will be found in the plaster. Using a 1/32" drill bit, carefully drill several holes through the cavity into the vacuum chamber below. The position of these holes should be carefully selected. In general the holes should be placed in the deeper recesses of the cavity to enable the plastic to get down into them.

The mold is now ready to be used. Figure 1 shows the completed assembly. The vacuum reservoir tank is connected by means of pressure tubing to the aspirator which evacuates the tank. The vacuum reservoir tank is also connected through the copper tubing and pressure hose to the plaster mold with a quick opening valve in the line between the mold and the tank. As the water faucet is turned it evacuates the tank. The air valve is closed so as to let the vacuum build up in the tank.

The drawing operation itself is very simple. A sheet of plastic several inches wider and longer than the mold face is heated in the oven until limp. The plastic is then placed over the mold so that it completely covers it and hangs loosely over the sides. It has to completely cover the mold cavity so that when the air valve is opened, the vacuum tank will evacuate the air from the vacuum chamber block and this in turn will evacuate the mold cavity causing the hot plastic to be drawn into the mold cavity.

After the plastic has cooled, it may be withdrawn from the mold and the excess plastic trimmed away from the desired piece with a jig saw. From here on the customary techniques for working plastic apply. It may be filed, sanded, and buffed to a high finish. It can be drilled, cemented, or otherwise treated as desired.

One of the simplest projects to start with which illustrates beautifully the versatility and scope of this method of fabricating plastics, is the vacuum drawing of a toy automobile. The pattern for the mold can be a dream car which has been whittled out of

Continued on page 20)

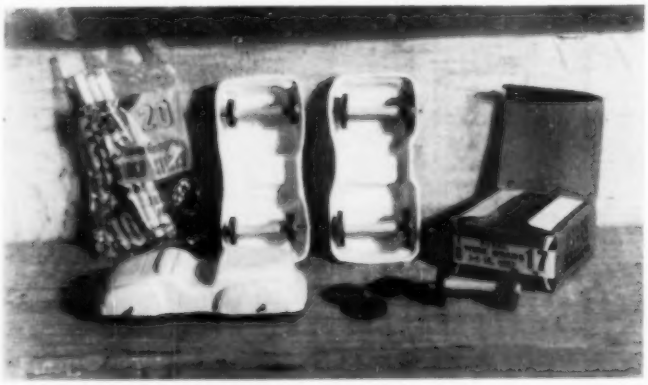


Fig. 4. This is the molded item, complete with wheels and ready to go.

Millions of Home "Laboratories"

Have Demonstrated For Years The Durability of BM-13080

BM-13080 is an improved impact BAKELITE Phenolic Molding Material that retains its mechanical strengths under long periods of immersion, exposure to high humidities, elevated temperatures, and mild alkali and acid solutions.

Millions upon millions of housewives, by putting their washing machines to hard service over a period of years, have provided the finest test imaginable to prove the durability of BAKELITE Phenolic BM-13080, employed for the agitators in these machines.

Such outstanding service has led naturally to other important applications. Today BM-13080 is employed for such parts as pump rotors, valves, baffle plates, gasoline pump components, soap injectors, water filters, and a great variety of equipment that calls for retention of impact strength, plus resistance to heat, moisture, and chemicals.

BM-13080 is readily molded into rich, black, smooth-surfaced products. Here are typical properties obtained by testing standard test specimens in accordance with ASTM procedures:

Molded Specific Gravity (D392-38)	**1.36-1.39**
Heat Distortion Temp. (D648-45T)	**290° F. min.**
Water Absorption (D570-42) Per Cent Gain in Weight	**0.7 max.**
Izod Impact Strength (D256-47T) Ft. lb./Inch of Notch	**0.46 min.**
Compressive Strength (D695-44T) psi	**25,000 min.**
Tensile Strength (D651-48) (⅛"), psi	**6,500 min.**
Flexural Strength (D790-45T), psi	**9,000 min.**
Modulus of Elasticity in Flexure (D790-45T), psi	**9×10^5 min.**

You, too, may have need for a superior phenolic plastic to meet exacting specifications for defense or essential civilian uses. If so, it will pay you to investigate BAKELITE Phenolic BM-13080.

For further information, present your detailed requirements to Department BY-43.

BAKELITE
TRADE MARK
Phenolic
PLASTICS

TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide & Carbon Corporation
30 East 42nd St., New York 17, N. Y.

THE *Injection* MOLDERSCOPE

BY A. R. MORSE
Injection Molder's Supply Co.

The SPE Injection Machinery Symposium is here dissected by a critical and sympathetic observer.

Report on Injection Machinery Makers' Panel of Experts:

Last month I promised to report on Islyn Thomas's courageous effort to elicit some timely "dope" from his panel of injection molding machinery experts. Sol Blitz of Noma Electric has already summed up the weakness of the forum when he said that they should have faced the panel with a few trouble-ridden injection molders. As it was, the experts played their cards close to their chests and we did not get a peek at them.

Well, to start, they talked a little about plunger clearance, especially on preplastifying units. No one said anything except Jim Wilson who said Watson Stillman has the answer to this nifty little obstacle to our industry's progress. But he didn't tell us HOW to push on hot thermoplastic and not run your scrap from the normal ½% up to 20%.

Then came a few pregnant remarks about piece cross section in relation to injection machine clamping capacity. Everyone agreed it would be nice to know what an injection machine would really clamp, but no one knew how to measure or rate this feature, except that piece thickness definitely ties in with clamping ability, and the thicker the piece the easier it is to clamp. Well of course it is. You can open almost any injection machine up from .010 to .030 and still **not** flash it—and the hydraulic machines are by far the worst offenders in making overweight injection molded pieces without flashing, and running the piece cost up from 5 to 20c almost unbeknownst to the injection molder unless he mikes each piece. I thought Jim ducked this point like the expert he is, and no one hit him with the crux of the matter as they should have. This a touchy subject to discuss openly in the injection trade. But something like Jobst's automatic shut-off to stop the injection pressure at a certain point will have to come along before you can get positive piece thickness control—a thing now achieved more readily on the mechanical clamp than on the hydraulic. An easy answer is this: make the part thicker. Now where did I hear that before? And supposing the economics just won't stand that extra .020 over some 250 square inches of molded part? Well—there you see what the panel could have developed if they had a man like R. K. Gibbs of Tri State Plastic Molding Company (who pioneered thin section molding of large parts, and who is one of the leading injection molders of our day) stand up and harass the experts.

The panel then kicked preplastifying around a little more.

No contamination again said Wilson. Higher plunger speed and lower injection pressure were mentioned as a result of our industry's newest cure-all, and the eventual effect of these two factors on injection machine design was guessed at. I suggest we lick preplastifying first before you duplicate the mistake of building an injection machine around an idea before you know enough about it. The fatal weaknesses in the one machine all resulted from a theoretical approach to this matter of preplastifying. Crown deserves a lot of credit for the pioneering they did, and their work will be the groundwork—by fair means or foul—of some of the preplastifying units that will hit the market this year and next.

They then got onto whether a heater should be designed for a specific material. Lester has done most in this connection—but whether they did it to make a machine stay sold or because they really had an answer is one of our little trade secrets. Is there REALLY any difference between a styrene and a vinyl heater? But give Dave Sloan credit for trying to think along the right lines. I think the day will come when each material has a heater of its own but that day is 20 years off. The IMMEDIATE step is to adjust the capacity of the heater to the size of the shot, and not to fricasee a 10 lb. charge in a heater when shooting only 2-4 oz. In other words, use a 4 oz. or 12 oz. conversion heater on an 8 oz. machine instead of under or overshooting the 8 oz. heater, WHATEVER THE MATERIAL. That is the empirical answer right now, but I don't think the exerts brought this tidbit out. If a machine is well underrated on styrene, it should do a dandy job on vinyl—but, golly, that is a difficult thing for Lester or anyone else to put into good sales jargon! You can't blame the experts for hedging around the edges of this one!

They next got onto standardization—give Islyn credit for keeping them jumping along. Not a chance of achieving injection machine rating standards if we read between the lines. Reed-Prentice who used to sell more injection machines than the whole rest of the industry, (and may still sell more in number of machines, but not in dollar volume than any other single company) did not even have a representative at the conference. Talk of standardization is wishful thinking and the injection molder might as well face it. If you standardize, all the machines would take on the features of one, and you would sacrifice progress as competition went out the window.

Standardization would take the heat off the several injection machinery people and they would not need to change. Goodness knows the machine tool and press background of the injection machine makers today with their idea of progress being a change in chief engineers and design once every 20 years makes the progress of the last ten years all the more remarkable. But don't take away the impetus to further change by trying to standardize injection machine design at this critical juncture. If one man couldn't tell just a little different story about his heater than the next one, the injection molder would have nothing to gripe about!

Automatic Molding

Hronek of Fellows took over on automatic molding. You would think it was something new to hear about it, but the field is really in its second infancy—and a lusty one. The old 10A4 Reed has still to be eclipsed, but the Fellows, the Lester and the MacRay 4 oz. machines may be on the way to do it. Why isn't Reed in the 4 oz. picture? No one knows, but probably the limitations of their 2 tie bar design have about put them out of the running in the 4 oz. field.

T-Slots

Well, the session ended up with someone mentioning T slots instead of tapped holes on injection machine platens, as the tapped holes strip out. I did not get a chance to bring up my IMS Platen Holesavers (commercial plug) designed to repair these stripped holes—but the point is a minor one. Some injection machines have T slots, but I suspect the reason tapped holes predominate would be found in the possible weakening of the platen if you put T slots in it—at least in the injection field where platen thickness has been so grudgingly gained over the years, and platen flexing has been such an elusive and difficult factor from an engineering viewpoint.

Third Prize 1950 SPE Prize Paper Contest

The Elevated Temperature Creep And Fatigue Properties Of A Polyester Glass Fabric Laminate

By William N. Findley[1] and Will J. Worley[2]
University of Illinois

Summary

The following tests are reported for glass-fabric laminates molded at 13 psi. pressure with Laminac 4126 polyester resin; tension and compression tests at 77F; time-to-fracture creep test at 77 F and 400 F; fatigue tests at 77 F in still air and in an air-blast; and fatigue tests at 180 and 300 F.

The fatigue strength of this laminate was found to be much more sensitive to temperature than that of laminates previously tested. A decrease in the fatigue strength at 10^7 cycles of about 67 per cent (from 10,900 psi. at 77 F to 3500 psi at 300 F) was observed. The effect of temperature on the fatigue strength appeared to follow the power law previously observed.

The time-to-fracture tests indicate a reduction in creep strength at 120 hr. under load of about 21 per cent from 31,500 psi. at 77 F to 25,000 psi. at 400 F. Substantial shrinkage was observed to occur with time at 400 F.

Introduction

Glass fabric laminates are of considerable interest at the present time as a high strength temperature resistant material which is sufficiently transparent to radar waves to be used as antenna housings for aircraft and guided missiles. Such a material must have the strength to withstand the pressure and vibration of high speed flight and must be resistant to deterioration by fatigue or dimensional changes by creep resulting from the high temperatures which may occur during transonic or supersonic flight.

The purpose of the present investigation was to determine the pertinent strength properties of one of the materials which might be suitable for the uses mentioned above. To this end the effect of temperature on the creep, time-to-fracture under constant load, and fatigue properties of a glass fabric laminate molded with a polyester resin were determined.

Material:

The material tested in this program was a glass fabric laminated with a polyester resin by Owens-Corning Fiberglas Corp. The resin was Laminac 4126 made by American Cyanamid Co. by a single stage process. It was described as: having a fast reaction rate; using 1.6 per cent Luperco as a catalyst; using no solvent; being composed of 100 per cent solids; and having a viscosity at 77 F of 2.4 poises.

The fabric was Owens-Corning Fiberglas 181-114, heat cleaned and water repellent. It was composed of yarn number 225-$\frac{1}{3}$ for both warp

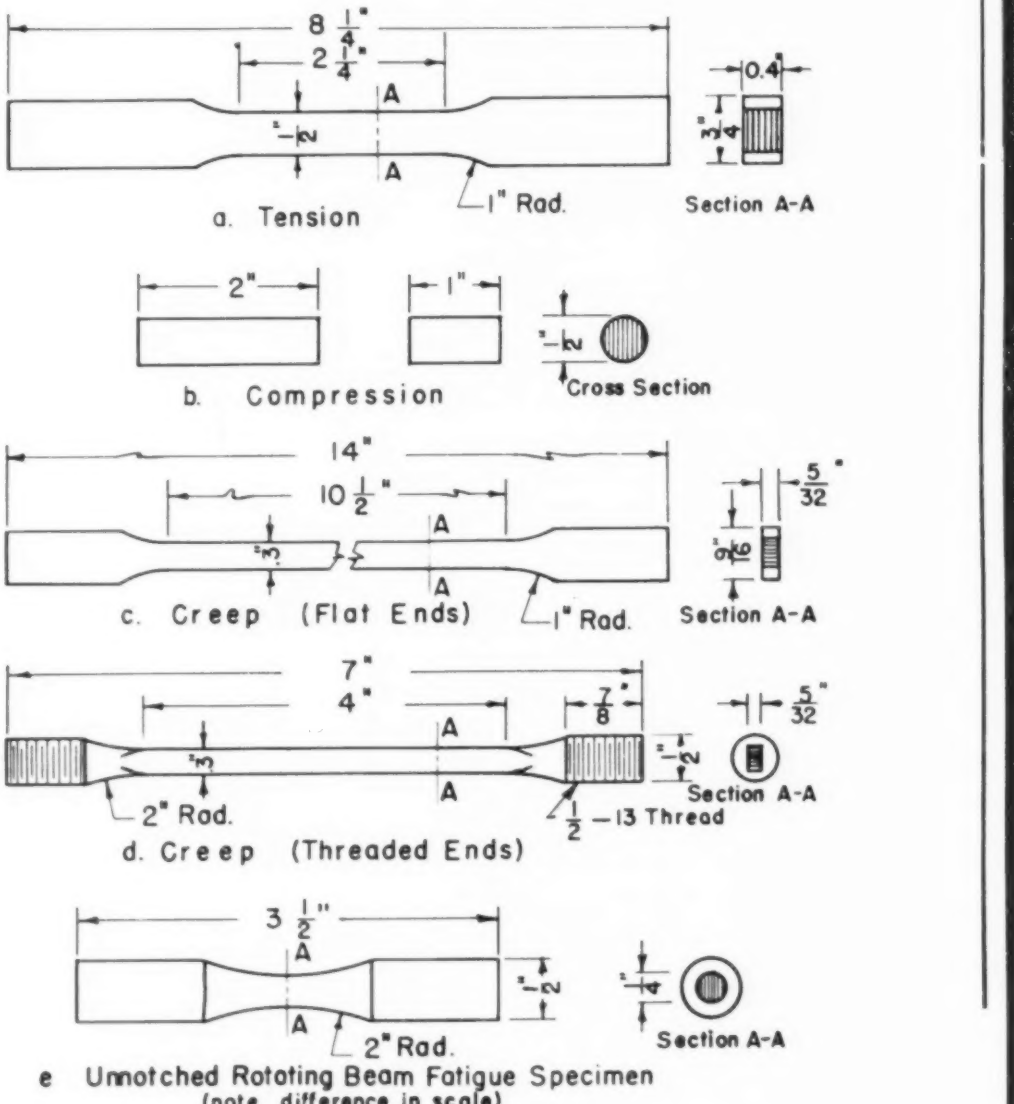


Fig. 1 Static, Creep and Fatigue Specimens
The Cross-hatched Lines Indicate Planes of Laminations

[1]Research Associate Professor and Assistant Professor, respectively, Department of Theoretical and Applied Mechanics, University of Illinois, Urbana.

and woof having 5 turns per inch. (z) in first twisting and (s) in the plying operation. The weave used was 8 harness satin which yielded a fabric thickness of 0.0085 in.

The following physical properties of the fabric were reported by the manufacturer; the weight raw was 8.90 oz. per sq. yard; the thread count was 57 by 54; and the minimum tensile strength was 340 lb. per in. for the warp and 330 lb. per in. for the woof.

Fifty-eight plies of fabric were parallel laminated (with a reported resin content of 33 to 36 per cent by weight) in a diaphragm press which was heated by circulating hot air. A pressure of 13 psi. was applied to the laminate during the following temperature cycle: 180 F for ½ hr.; 200 F for ½ hr.; 220 F for ½ hr.; 250 F for 2 hr.; and cooled in the press to 100 F.

Specimens

The dimensions of the test specimens are shown in Fig. 1, All specimens were cut from the sheet with their longitudinal axes parallel to one another and parallel to the warp of the fabric. The creep specimens for tests at 77 F were cut from the original sheet with a milling cutter in such a way that the wide side of the specimen was perpendicular to the plane of the sheet. The reduced section and radii at the ends were formed on a shaper.

Creep specimens used at 400 F were machined by threading the ends and then machining the test section on a shaper. Greater difficulty was experienced in machining this laminate than we have experienced with several other glass laminates. Our experience in machining the material indicated that it was more susceptible to delamination than others.

Testing Equipment

All tests were conducted in a room maintained at a constant temperature of 77 plus or minus 1 F and a relative humidity of 50 plus or minus 2 per cent. For the static tension and compression tests a Tinius Olsen testing machine of 10,000 pound capacity and beam weighing was used. A compression tool was used in the compression tests to insure axial loading and averaging extensometers were used for all tests.

The fatigue tests at 77 F were performed on a newly designed vertical spindle fatigue machine of the rotating cantilever beam type. A special device was incorporated in this machine to permit fine adjustments of the specimen grip so that the spindle would run true. It was originally planned to use this machine for the high temperature tests also, but the temperature control apparatus was not available in time so that our older equipment was used for these tests.

The high temperature fatigue machine, static test apparatus and room temperature creep apparatus are described in detail and illustrated in another report. [4] High temperature creep tests were conducted on a commercial creep testing machine loaned to the University by Baldwin Locomotive Works.

Test Procedure

The procedure followed in conducting the tests is the same as described in detail in a previous report[4] except for the creep tests at elevated temperatures. All specimens were kept at 77 F and 50 relative humidity for at least two weeks prior to testing except as noted under "Results."

The static tests were performed at a nearly constant rate of head motion which was adjusted by means of preliminary tests so that the rate of straining was about 0.0016 in per inch min. The rate was measured as the slope of a strain-time diagram just below the strain at which the stress was no longer proportional to strain.

Fatigue tests were conducted in both machines at a speed of about 6100 rpm. Specimens for the tests at 300 F were placed in the machine, heat was applied and the specimens were allowed to remain at temperature for about one hr. before the fatigue test was started.

Creep tests at 400 F were conducted by mounting an individual specimen in the creep machine, fastening the extensometer to the specimen by means of spring-loaded screws having flattened points, heating the assembly to temperature and allowing the specimen to remain at temperature for 1 to 24 hr. before applying the load. The variation of temperature over the gage length of the specimen was found to be about 4F, and the variation during a heating cycle was about 2F. Other details of the

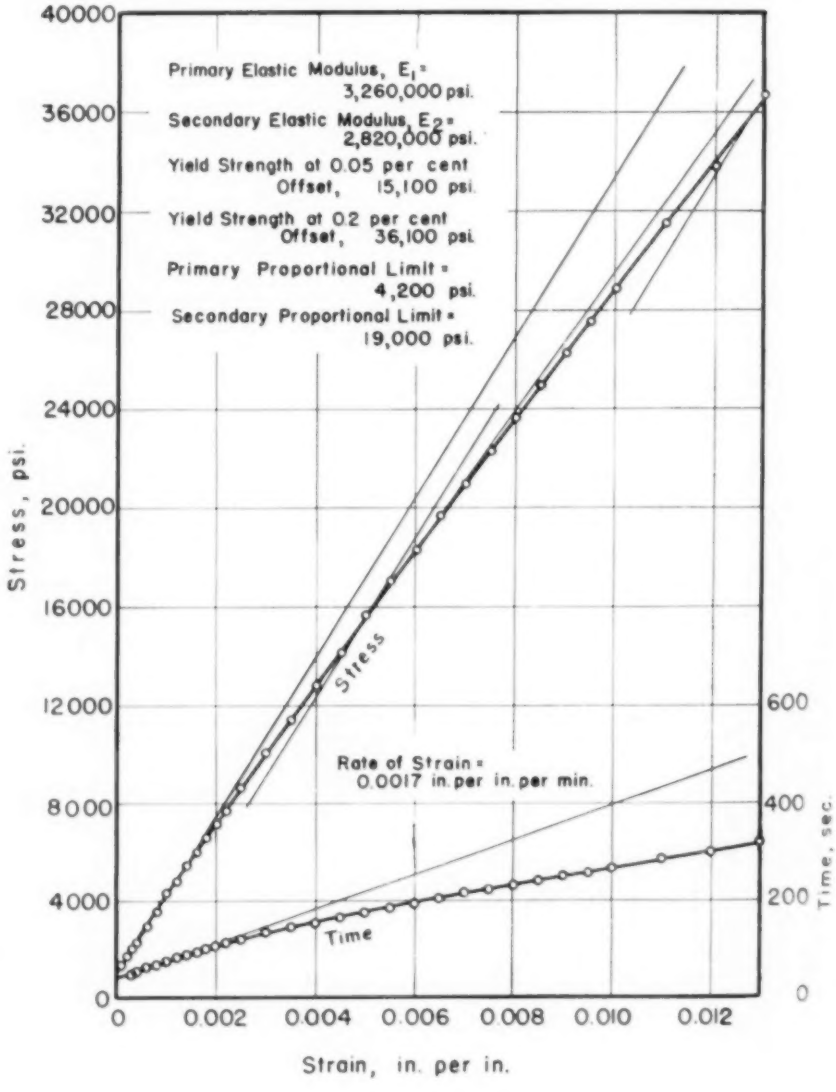


Fig. 2 TENSION TEST OF POLYESTER GLASS-FABRIC LAMINATE

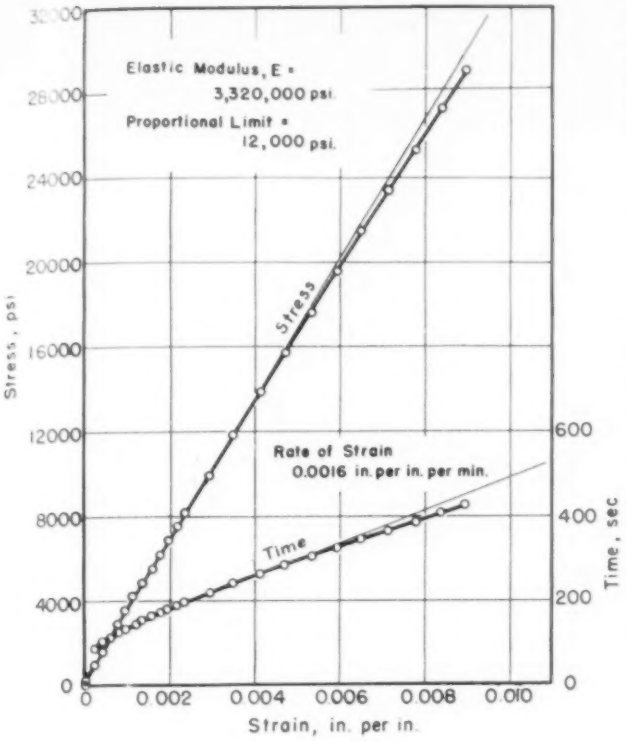


Fig. 3 COMPRESSION TEST OF POLYESTER GLASS—FABRIC LAMINATE

test were substantially as described in a pervious report. (1)

Test Data and Analysis of Results

Comparison of Three Sheets:

The laminate tested in this program was supplied in three sheets 36 x 36 x 9/16 inches. Flexural tests and compression tests were conducted by the Air Material Command on samples supplied to them from each of the three sheets. The ultimate flexural strength, modulus of elasticity, and proportional limit from flexural tests and the ultimate compressive strength obtained from these tests are reported in Table I. The values shown are average of two tests.

The magnitude of the resin content, specific gravity and hardness were also determined by the authors and are given in Table I for the three sheets. These data were collected after the main program of tests was under way with specimens prepared from sheet 1 was a chance selection and not the result of the fact that this sheet gave the poorest results in the tests reported in Table I.

Static Tension:

Stress-strain curves and time-strain curves for the tension tests at 77 F are illustrated in Fig. 2. It was observed that there was a rather abrupt change in slope of the stress-strain diagram at about 4000 psi. followed by a gradual curvature. This behavior was observed in our earlier tests(1) on a glass fabric laminate. More recently the slope of the nearly linear portion of the curve above the change in slope has been called the secondary modulus of elasticity.(2) The division of the stress-strain curve into two straight line portions is not so positive for the present tests as for these perviously reported.(1) There is more curvature in the lines in the present instance.

From curves such as Fig. 2 values of the primary and secondary modulus of elasticity, yield strength at 0.05 and 0.2 per cent, and primary and secondary proportional limits were obtained and are presented in Table II together with the ultimate strength and rate of strain.

The modulus of elasticity and ultimate strength were nearly the same as reported for the tests of a previous glass fabric laminate.(1) However, the yield strengths were approximately 50 per cent higher than those formerly reported.(1)

Static Compression:

Stress-strain curves and time-strain curves for representative compression tests at 77 F are illustrated in Fig. 3. There was a slight curvature(or change in slope) observed in all but one of the compression tests. The change, however, was much less pronounced than in the tension tests.

Values of modulus of elasticity, proportional limit, ultimate strength and strain rate are listed for all of the compression tests of two-inch specimens in Table III. Also listed are the values of ultimate strength obtained from compression tests of one-inch specimens. The ultimate strength of the one-inch specimens was about 5 per cent higher than that of the two-inch specimens.

Specimen numbers 31 and 47 were tested about eight months after the first specimens. It may be that aging caused the differences in modulus of elasticity and proportional limit observed, or the difference may result from the difference in the location of the specimens in the sheet.

The modulus of elasticity in compression is nearly the same as the primary modulus of elasticity in tension but the ultimate strength in compression is about ¾ that in tension.

A comparison with the tests of the previous polyester glass-fabric laminate shows that the modulus of elasticity in compression was practically the same but the ultimate strength of the present laminate was about 29 per cent less than the previous values.

Fatigues:

Rotating-beam fatigue tests were conducted in a room at 77 F and 50 per cent relative humidity both with and without an air-blast to cool the specimens. Tests were also conducted at 180 and 300 F in a cabinet located in the same room. However, no air blast was provided for these tests and the relative humidity in the cabinet was not known.

The test results are given in the form of S-N diagrams in Fig. 4. The upper three curves in Fig. 4 present the room temperature tests while the lower two curves present the test data for 180 and 300 F. The solid circles represent test data obtained for specimens tested in a horizontal-spindle rotating-cantilever beam fatigue machine mounted on a light weight base and springs. When mounted on this base the specimen vibrated so much that the machine was subsequently mounted on a heavy con-

Table I Comparison of Three Sheets

	Sheet 1	Sheet 2	Sheet 3
Ultimate Flexural Strength, psi	36,000	38,400	44,300
Modulus of Elasticity, psi. (from flexure test)	3,050,000	2,940,000	3,120,000
Proportional Limit, psi. (from flexure test)	10,800	14,200	11,500
Ultimate Compressive Strength, psi.	30,900	33,400	31,900
Specific Gravity	1.82	1.78	1.80
Resin Content, per cent by weight	31.7	33.8	32.3
Rockwell Hardness			
Parallel to the Laminations	M 102	M 108	M105
Perpendicular to the Laminations	M 116		M116

(1) "Mechanical Properties of Five Laminated Plastics," by W. N. Findley and W. J. Worley, National Advisory Committee for Aeronautics, Technical Note, No. 1560.

(2) Werren, Fred, and Norris, C. B., "Directional Properties of Glass-Fabric-Base Plastic Laminate Panels of Sizes that do not Buckle," Forest Products Lab. Report number 1803, April 1949. Note: The reference in this report to a secondary modulus of elasticity having been observed by Lamb and Axilrod for laminates other than glass fabric is incorrect.

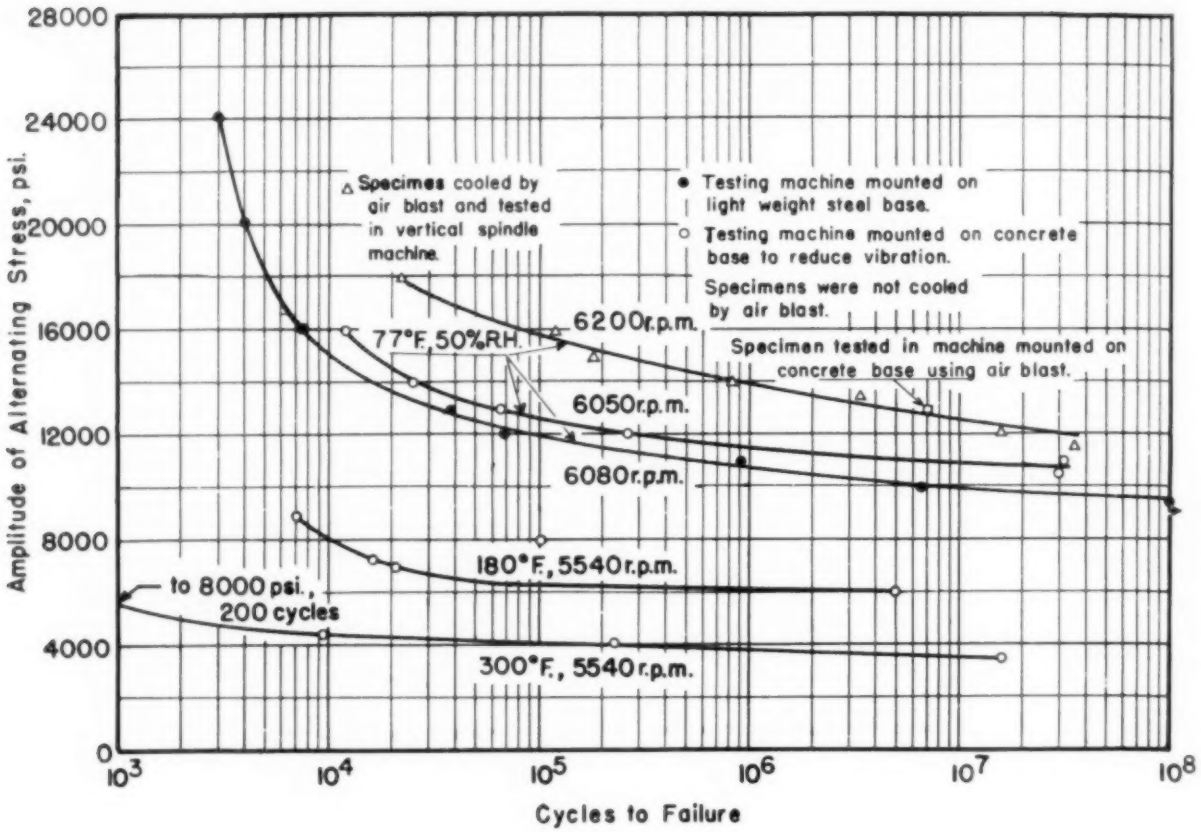


Fig. 4 S-N DIAGRAMS FOR FATIGUE TESTS WITH A ROTATING-CANTILEVER-BEAM MACHINE LABORATORY CONDITIONS 77 F, 50 PER CENT RELATIVE HUMIDITY

crete base placed on springs and the loading lever was stiffened to reduce the vibration. Data collected on the revised machine appear as open circles in Fig. 4. The specimens for both S-N diagrams were machined at the same time and were tested only five weeks apart so that the increase in strength must have been largely due to the reduction of vibration.

Additional tests at 77 F, represented by triangles, were obtained on a vertical spindle rotating-cantilever-beam fatigue machine using an air blast for cooling the specimens. One specimen was also tested in the horizontal machine with an air blast to cool the specimen. The datum for this specimen appears as a solid square on the upper curve. The agreement shown indicates that the two machines with air-blast gave about the same results. The reduction in strength of specimens tested without an air blast appears to have resulted from the rise in specimen temperature caused by heat generated by the bearings of the machine and internal friction in the specimen. However, aging may have had some effect since the tests without an air-blast were conducted about 9 months before the tests with an air-blast, and the former specimens were made about 7 months before testing and the latter only one month before testing.

The tests at 300 F were obtained on the horizontal spindle fatigue machine which was remounted in a controlled temperature cabinet for the purpose. Natural convection was used to circulate the air in the test chamber and no air blast was used in this series of tests.

It is apparent that the fatigue strength at 10^7 cycles for completely reversed cycles of stress decreased 67 per cent with increase in temperature from 10,900 psi. at 77 F to 3500 psi. at 300 F. Also the slope of the S-N diagrams decreased with increase in temperature. At 77 F the fatigue strength decreased 25 per cent from 10^5 to 10^7 cycles whereas, at 300 F the decrease over the same interval of cycles was only 17 per cent.

Speed of testing, which is known to affect the fatigue strength of plastics, may have influenced the data slightly since it was not possible to maintain exactly the same speed in all tests.

A comparison of the temperature

TABLE II—TENSION TESTS

Material	Specimen Number	Modulus of Elasticity, 10^5 psi. Primary	Modulus of Elasticity, 10^5 psi. Secondary	Yield Strength+ 0.05 per cent offset, psi.	Yield Strength+ 0.2 per cent offset, psi.	Proportional Limit Primary, psi.	Proportional Limit Secondary, psi.	Ultimate Strength, psi.	Rate of Strain, in. per in. per. min.
Laminac (Sheet No. 1)	2	3.22	2.80	15,300	35,800	4,000	19,000	41,500	0.0012
	3	3.25	2.78	15,400	36,000	4,200	19,000	38,800	0.0016
	4	3.31	2.84	14,500	36,100	3,600	18,500	44,200	0.0014
	5	3.26	2.82	15,100	36,000	4,200	19,000	40,500	0.0017
	6	3.26	2.78	14,800	36,000	4,000	19,500	41,200	0.0016
Average		3.26	2.80	15,000	36,000	4,000	19,000	41,200	

+All values of yield strength based on the offset from the line of primary modulus of elasticity.

TABLE III—COMPRESSION TESTS

Material	Specimen Number	Modulus of Elasticity 10^6 psi.	Yield Strength at 0.05 per cent offset, psi.	Proportional Limit psi.	Ultimate Strength psi.	Rate of Strain (at 8000 psi.), in. per in. per min.
Laminac	2 in. Long					
(Sheet No. 1)	1	3.31	-[1]	9,000	33,200	0.0016
	2	3.36	-	13,000	34,100	0.0015
	3	3.32	-	12,000	30,400	0.0016
	4	3.23	-	-[2]	29,900	0.0015
	5	3.33	-	17,000	29,700	0.0014
	6	3.11	-	11,000	29,600	0.0015
	31	3.13	-	21,000	27,600	0.0015
	47	3.15	-	23,000	29,900	0.0016
	Average	3.24			30,550	
	1 in. Long					
	7				29,800	
	9				31,300	
	10				34,900	
	11				29,300	
	12				34,200	
	Average				31,900	

[1]Specimens failed before 0.05 per cent offset was reached.
[2]Linear stress-strain diagram to last strain reading recorded before fracture.

TABLE IV—CREEP TESTS OF LAMINAC GLASS FABRIC

Test	Temperature, Deg. F.	Relative Humidity, per cent	Stress, psi.	Strain at 20 sec., in/in	Strain at 40 hr. (corrected for shrinkage), in/in	Time at Temperature before Loading, hr.	Secant Modulus, Stress divided by strain at 20 sec., 10^6 psi.	Time to Fracture, hr.	Creeposity from 20 sec. to 40 hr., per cent	Shrinkage at 40 hr., in/in	Strain at 40 hr., in./in., Computed from Eq. 6
Creep	77	50	30,000	0.01117	0.01225	2090	2.68	194.[1]	9.7		0.01250
			30,800	0.01149	0.01275	2500	2.68	216.2	11.0		0.01287
			32,000	0.01188	0.01297	8130	2.69	57.9	9.2		0.01365
			33,000	0.01248	0.01401	3240	2.65	49.	12.3		0.01378
			34,000	--[2]	--[2]	8270	---	14.1	---		0.01423
			36,000	0.01347	--	2470	2.67	4.9	---		0.01509
						Average	2.67		10.6		
Shrinkage	400	--	0	0	0	0	---	----	---	0.00032	
Creep	400	--	15,000	0.00578	0.00697	261.9	2.60	----	20.7		0.00759
			20,000	0.01004	0.01265	23.2	1.99	----	26.0		0.01012
			25,000	0.01209	0.01807	16[3]	2.07	121.4	49.3		0.01267
			25,000	--	--	5 to 6	---	0.008[4]	---		
			28,000	0.01201	--	68.4	2.33	0.8	---		0.01420
Recovery	400	--	0[5]	0.005539[6]	--	Average	2.25		32.0		
							2.71	----	---		

[1]Specimen failed in grip.
[2]Strain not known.
[3]Temperature was 500 F for 30 min.
[4]Specimen was damaged by extensometer.
[5]Specimen unloaded from 15,000 psi. stress.
[6]Change in strain on unloading.

sensitivity of this laminate with available data on other laminates indicates that the present laminate is much more temperature sensitive than the previous polyester glass-fabric laminate tested by the authors.[1] and is also much more temperature sensitive than all other laminates tested by the authors.[1,3] The six laminates tested previously in fatigue at different temperatures by the authors show a nearly linear relation between log fatigue strength $\acute{o}$ and log absolute temperature (T) which corresponds to an equation of the form

$$\acute{o} = pT^{-q}$$

[3] Findley, William N., "Fatigue Tests of a Laminated Mitscherlich-Paper Plastic," Proc. A.S.T.M., Vol. 45, 1945, pp. 878-903.

where q is the temperature sensitivity index (or slope of the line in a log-log plot) and p is a constant, equal to the indicated fatigue strength at 1 deg. Kelvin.

The available data for the present laminate indicate that equation (1) may apply in this instance also as shown in Fig. 5. The straight lines represent equations of the form of

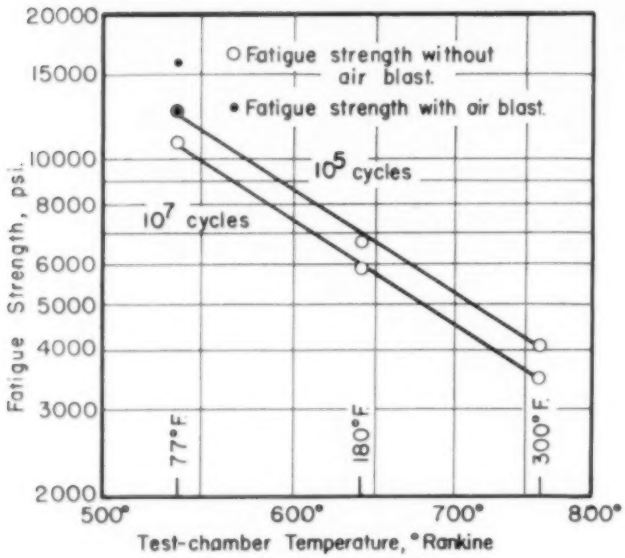


Fig. 5 EFFECT OF TEMPERATURE ON THE FATIGUE STRENGTH OF POLYESTER GLASS-FABRIC LAMINATE

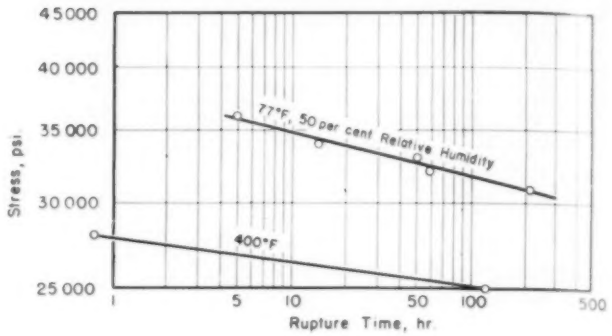


Fig. 6 STRESS vs. TIME-TO-FRACTURE IN CREEP TESTS OF POLYESTER GLASS-FABRIC LAMINATE

equation (1). From the relation shown in Fig. 5 between fatigue strength and temperature of the test chamber, for tests without an air blast, and the fatigue strength at 77 F without an air blast the temperature of the specimens without an air blast may be estimated. This may be done by drawing lines parallel to those shown but through the solid circles and reading the temperature indicated by these lines at the given fatigue strength. This procedure indicates the temperature of specimens without an air blast at the room temperature of 77 F to have been about 120 and 100 F at the fatigue strength for 10^5 and 10^7 cycles respectively. These temperatures are somewhat higher than the values obtained by other methods for other laminates.

The temperature sensitivity index q of the fatigue strength of the present laminate is 3.04 whereas for the previously tested glass-fabric molded with a polyester resin q was 0.493. For the present laminate p is 2.15 x 10^{12} psi., based on the test chamber temperature.

At 77 F the present glass-fabric laminate had a fatigue strength at 10^7 cycles about 14 per cent less than the former glass-fabric laminate,[1] whereas, at 300 F the present glass-fabric laminate had a fatigue strength at 10^7 cycles only about 17 per cent higher than a previously tested paper laminate.[3]

Time-to-Fracture Tests:

The effect of stress on the time-to-fracture in creep tests at such high stresses that rupture occurred is shown in Fig. 6 for tests at 77 F and for two tests at 400 F. One other creep test at 20,000 psi. and 400 F did not fracture within the duration of the test; while another specimen failed in 30 sec. at 25,000 psi. and 400 F. The latter specimen was thought to have been damaged during installation in the creep machine.

Within the range of the available data the stress versus rupture-time at 77 F shows a straight line relation as a log-log plot as illustrated in Fig. 6. The creep strength at 100 hours decreased with temperature from 31,800 psi. at 77 F to 25,100 psi. at 400 F.

The creep strength of the present laminate decreased much more rapidly with time-to-fracture than the glass fabric laminate molded with Plaskon 920 resin reported by Battelle.[4] The creep strength at 77 F of the present laminate decreased from 34,800 psi. at 10 hours to 31,800 psi. at 100 hr. The corresponding creep strengths of the material reported by Battelle were 29,600 psi. and 29,200 psi. at 80 F.

The stresses for tests at 400 F have not been corrected for changes in cross sectional area due to thermal expansion.

Creep Tests:

Creep tests at 77 F and 400 F are shown in Figs. 7 and 8 respectively for several stresses. The creep curves shown are similar in shape to those observed in other tests of laminates.[1,5,6,7]

A test at 400 F with zero stress indicate that the material is subject to substantial shrinkage at that temperature. The shrinkage is nearly a linear function of time over the time interval recorded. Thus the creep curves should be corrected for the effect of shrinkage to obtain a more accurate creep relationship. Such a correction would increase the slope of the creep curves so that the curve for 20,000 psi. at 400 F would have

What Are your NEEDS?
TOUGH JOB ENGINEERED?
SAMPLES OR SHORT RUN?
D.O. OR COMMERCIAL WORK?
OUR experience solves problems for YOU
Why not send your problems
TO
BARRIER-PRIBBLE AND CO., INC.
P.O. BOX 55, FT. WAYNE, IND. — Ph. A-59884

Let US Be

YOUR extra hand

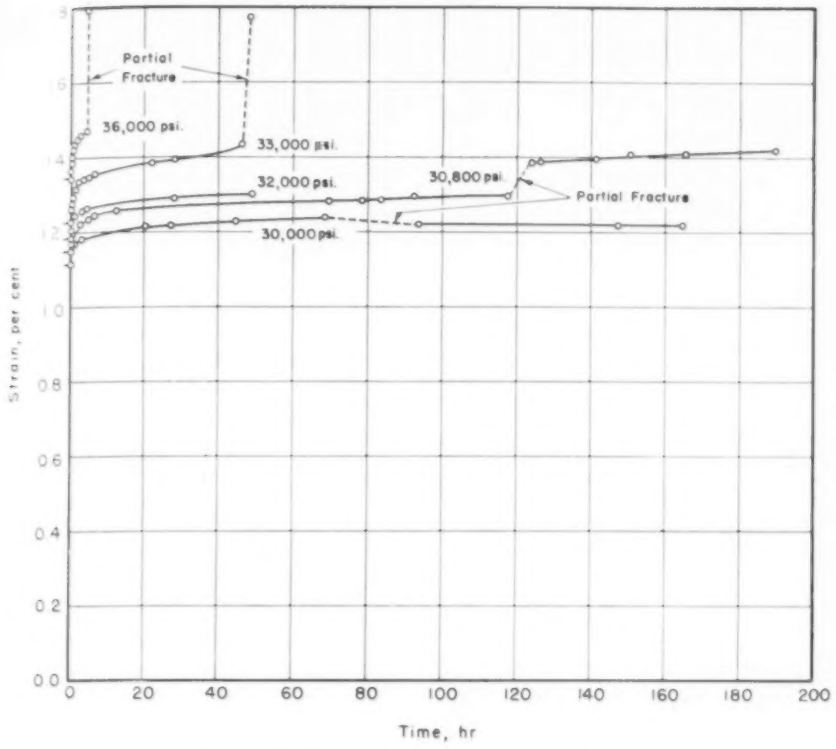


Fig 7 CREEP TESTS OF POLYESTER GLASS-FABRIC LAMINATE AT A TEMPERATURE OF 77 F

a substantial creep rate instead of practically zero rate as shown.

Three of the tests at 77 F (Fig. 7) show the effect of fracture of one or more layers of the laminated specimen in producing a sudden increase in strain. This action was usually followed rather soon by complete fracture. The reverse effect was observed in the test at 30,000 psi. Here the indicated strain decreased and remained nearly constant when a portion of the specimen fractured. This may have been the result of the extensometer clamps slipping and adhering to the fractured layers of the specimen after slippage so that no further creep was recorded.

The specimen initially tested at 20,000 psi. at 400 F (Fig. 8) was continued as a step test to determine the stress level at which fracture was to be expected. The stress was increased at intervals by increments of 2000 psi. until fracture occurred immediately after the stress was increased to 26,000 psi. The sudden decrease in strain at about 0.6 hr. and again at about 140 hours resulted when the nut on the lower loading rod was tightened to raise the loading lever. It is thought that the apparent decrease in strain resulted from the slight twisting of the specimen when the nut was tightened. Such twisting would change the point of contact of the electric contacts in the extensometer of the Baldwin creep machine and would probably result in a false strain indication. Since gradual untwisting may occur during the test and create false strain indications, this characteristic of the extensometer used in the 400 F tests is undesirable.

Tests at zero psi. and 15,000 psi. were performed in sequence on the same specimen and were followed by a few strain readings during recovery. It was observed that the initial strain was substantially less on loading this specimen than was expected from a stress of 15,000 psi.

The values of the secant elastic modulus computed from the strain at 20 sec. under load are given in Table IV. All values for 77 F were about the same and slightly less than the secondary modulus measured in the tension tests. An examination of the values for 400 F shows that the stiffness of the laminate increased with the duration of exposure to 400 F. An increase of 30 per cent is shown for increase in exposure time from 16 to 262 hours. The data presented by Axilrod and Sherman[18] show a similar effect for two of the four polyester-glass fabric laminates which they tested in flexure. The other two tested by Axilrod and Sherman showed the opposite trend.

That the stiffness of the specimen at 15,000 psi. was further increased during the creep test is shown by the fact that the instantaneous strain on unloading was larger than that on loading, as indicated by the values of secant modulus in Table IV.

The above observations mean that a series of creep tests must all be ex-

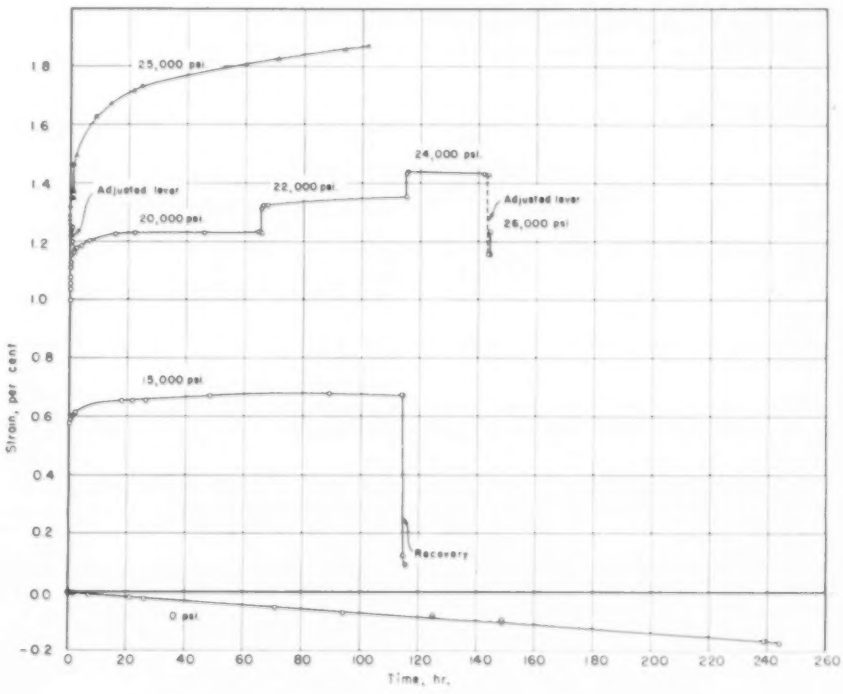


Fig.8 CREEP TESTS OF POLYESTER GLASS-FABRIC LAMINATE AT A TEMPERATURE OF 400 F

[14] Andrews, C. W., "Elevated-Temperature Tests of Plastic-Glass Laminates." Fifth Progress Report on contract W-33-038-ac-21106, Wright-Patterson Air Force Base, April 19, 1949.

[15] Findley, W. O., and Worley, W. J., "Short-Time Static Tests and Creep Tests of a Paper Laminated Plastic," Proc. A.S.T.M., Vol. 44, 1944, pp. 949-966.

[16] Marin, Joseph, "Static and Dynamic Creep Properties of Laminated Plastics for Various Types of Stress." NACA Technical Note No. 1105, 1947.

[17] Worley, W. J., and Findley, W. N., "The Effect of Temperature on the Creep and Recovery of a Glass Fabric Laminate Molded With a Melamine Resin." To be published in Proc. A.S.T.M., Vol. 50, 1950.

posed to temperature the same length of time prior to testing if the results are to be accurately comparable. It also means that the results of the creep tests are complicated by uncontrollable variables. Not only does the material creep with time at a constant temperature and load but the strain is affected by shrinkage, by change in stiffness and probably by change in creep resistance resulting from the change in structure of the material with exposure to high temperature.

The values of the per cent increase in strain during the creep test (called the creepocity [1]) from 20 sec. to 40 hr. are given in Table IV for each test together with the values of the strain at these two times. It has been shown that the creep behavior of this material may be approximately represented by an equation of the form

$$\varepsilon = C\,T\,e^{-A/T}\,\text{Sinh}\,\frac{\acute{o}}{BT}\,(1 + t^n)$$

as shown in previous reports, [7,9,10,11] where ε is the strain, $\acute{o}$ the stress, T is the absolute temperature, t is the time under load and C, A and B are constants of the material as long as the structure or composition of the material does not change. The exponent n is presumed to be a constant but may be found to depend on temperature[9]. The present data have such implications since the creepocity, which is directly related to n, varies from 0.106 at 77 F to 0.32 at 400 F. However, the creepocity at 400 F. is not too reliable.

From Eq. (2) and the data given in Table IV the constants, A, B, C, and n may be computed as follows: The exponent n may be most readily computed from the creepocity by the relation[7] where Φ_{t_2} is the creepocity

$$n = \frac{\log\left(\frac{\Phi_{t_2}}{50} + 1\right)}{\log t_2}$$

from 1 to t_2 hours. This calculation yields 0.0263 at 77 F and 0.0764 at 400 F. as the values of n. Since the data for Φ_{t_2} at 400 F. are not very conclusive n will be assumed to be idependent of temperature and equal to 0.0263.

If Eq. (2) is rewritten as

$$\varepsilon = \varepsilon_o\,\text{Sinh}\,\frac{\acute{o}}{BT}$$

where

$$\varepsilon_o = CTe^{-A/T}\,(1 + t^n)$$

the value of B may be determined by trial so as to yield the best agreement with the experimental values of strain such as strains at 20 sec. The trial yields 186 lb./sq. in. deg. k. as the value of B. The corresponding value of ε_o for 77F. is O.0366; and for 400 F. is 0.072. The constants C and A may now be found by solving simultaneously the two equations formed from Eq. 5 by substituting the values of ε_o, T and t for the two temperatures and a given time. The results are C = 6.31 x 10^{-5} in./in. deg. K. and A = 295 deg. k.

Thus Eq. (2) for the creep behavior of the polyester glass-fabric laminate becomes:

$$\varepsilon = 6.31 \times 10^{-5}\,Te^{-295/T}\,\text{Sinh}\,\frac{\acute{o}}{186T}\,(1 + t^{0.0263})$$

The equation may be tested by computing the strains at say 40 hr. and comparing them with the test results. The computed values are in reasonable agreement with the test data as shown in Table IV.

The creep rate v may be expressed as a function of stress, temperature and time by differentiating Eq. (6)

$$V = 6.31 \times 10^{-5}\,Te^{-295/T}\,\text{Sinh}\,\frac{\acute{o}}{186T}\,(1 + 0.0263t^{-0.9737})$$

It should be recognized, however, that values of creep or creep rate computed for time, temperatures or stresses beyond the scope of available data should be used with caution since the constants of the material cannot be determined with great precision and the composition or structure of the material will change under certain combinations of stress, temperature and time.

Fractured Specimens:

A picture of representative fractured specimens is shown in Fig. 9. It was observed that the nature of the creep fractures was markedly different from the tension-test fractures. The disintegration was much more general in creep than in the tension tests—especially at 400 F.

Conclusions

1. Three sheets prepared at the same time showed somewhat different mechanical properties.

2. The stress-strain diagrams in tension and compression show more curvature than observed in glass fabric laminates previously tested.

3. The modulus of elasticity (3.26 x 10^6psi.) and ultimate strength strength (41,200 psi.) in tension were about the same as observed in tests of a previous laminate, but the yield strengths were about 50 per cent higher.

4. The modulus of elasticity in compression was about the same as the primary modulus in tension and about the same as that of the glass fabric laminate previously tested.

5. The ultimate strength (31,200 psi.) in compression was ¾ that in tension and 29 per cent less than that of the glass fabric laminate previously tested.

6. The fatigue strength at 10^7 completely reversed cycles decreased from 10,900 psi. at 77 F. to 3500 psi. at 300 F. This is a much greater temperature sensitivity than observed for other laminates tested by the authors.

7. The data indicate that the relation between temperature T and fa-

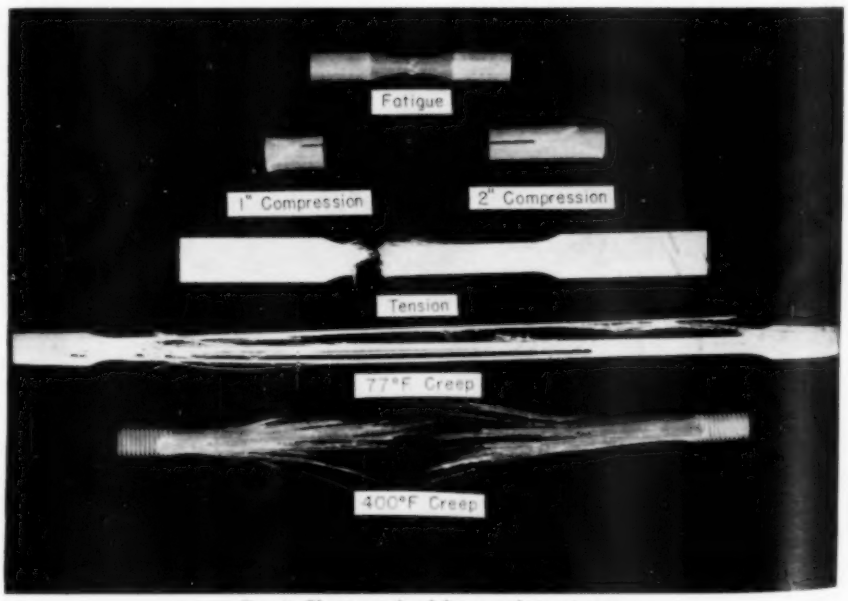


Fig. 9. Photograph of fractured specimens

(8 Axilrod, B. M., and Sherman, M. A., "Flexural Properties of Some Glass Fabric Base Plastic Laminates at Elevated Temperatures," Air Force Technical Report, No. 5940, February 1950.

(9 Findley, W. N. "The Mechanical Equation of State with Special Attention to Creep of Plastics," Soc. of Plastics Engineers Journal, Vol. 6, No. 10, December 1950, p. 13.

(10 Findley, W. N., Adams, C. H., and Worley, W. J., "The Effect of Temperature on the Creep of Two Laminated Plastics as Interpreted by the Hyperbolic-sine Law and Activation Energy Theory." **Proceedings, American Society for Testing Material,** Vol. 48, p. 1217, 1948.

(11 Findley, W. N., "Creep Characteristics of Plastics," 1944 Symposium on Plastics A.S.T.M. (Philadelphia, Pa.), 1944, p. 118.

tigue strength $\acute{o}_f$ may be expressed by the relation $\acute{o}_f = pT^{-q}$ is the temperature sensitivity index and $p = 2.15 \times 10^{12}$ psi. is a constant.

8. The fatigue strength of this laminate is less than that of a polyester glass-fabric laminate previously tested.

9. The creep strength at 100 hours decreased from 31,800 psi. at 77 F. to 25,100 psi. at 400 F.

10. At 400 F substantial shrinkage was observed together with an increase in modulus of elasticity with time at temperature.

11. The per cent increase in strain (creepocity) during a creep test at 77 F. from 20 seconds to 40 hours was about 10.6 per cent. At 400 F. the creepocity varied from 20.7 to 49.3 per cent.

12. A method of interpolating and extrapolating creep test results was reviewed and applied to the test data.

Acknowledgments

The financial assistance of the United States Air Force, Air Material Command, is gratefully acknowledged.

This project was a part of the work of the Engineering Experiment Station of the University of Illinois, of which W. L. Everitt is Director, in the Department of Theoretical and Applied Mechanics, of which F. B. Seely is Head. The authors wish to express their thanks to Robert E. Ruff, Jr. and to Alfred H. Rosenberg for their assistance in collecting and organizing the static test data presented, and to Dean Bailey and Gordon E. Chicoine for collecting the fatigue test data. Credit is also due Harlan E. Anderson and Lael B. Taplin who assisted with the preparation of the report.

Klippings From Kosy

(Continued from page 4)

The next meeting of the Detroit Section will be held on Friday, April 27, 1951. A speaker from the Crucible steel Co. will talk on, **"Steels for the Plastics Industry."** A large turnout is expected.

Latest addition to the Evans-Winter-Hebb gang is Walter Kuchts, who becomes foreman in charge of quality and finishing. He was formerly associated with American Plastics in Detroit.

What's New?

(Continued from page 2)

and equipment. Company was represented by Mr. Harry M. Brown, General Sales Manager, and Mr. Thomas Whelan, District Manager of the Houston office.

TEXTILE MILL SUPPLIES

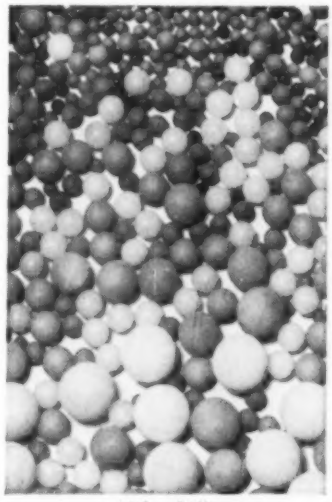
The mechanical goods division, United States Rubber Company, announced today that it has developed and started large scale production of a new line of specialties made of both plastics and rubber for the $75,000,000 yearly market in textile mill supplies.

The new line consists of nearly 30 types of specialties for yarn carrying operations and textile machinery. Included are such items as quills, spindle bumper tubing, lap winder rolls, sand roll covering, warp compressor roll covering, spinner belts, cop butts, spinning and card room cots, tapered warp spinning tubes, spooler sleeves, and other molded and extruded specialties.

PLASTIC BALLS BY ACE

With the introduction of nylon plastic balls, mass-produced to close tolerances, manufacturers can now take advantage of the many superior properties of this plastic for use in valves, valve components, specialized friction bearings, dedents, mechanical checks and numerous other commercial and industrial applications. The new nylon balls are introduced, for the first time anywhere, by Ace Plastic Company.

In comparison with other plastics, the Ace nylon balls, in sizes from $\frac{1}{8}$" to $\frac{3}{4}$", and with tolerances to plus or minus .001 provide toughness at low temperatures, are abrasion-



Nylon Balls

resistant, offer stability at high temperatures, lightness in weight and chemical resistance.

For example, the thermal properties of nylon balls have a flow temperature of 480. The coefficient of linear thermal expansion is 5.5 x 10.5. There is a low thermal conductivity of only 1.7. Electrical properties offer a short-time dielectric strength of 385, a 60-cycle dielectric constant of 4.1. Water absorption is very low, 1.5. Flammability is self-extinguishing.

A bulletin explaining the Ace services and listing sizes of Ace nylon balls and also balls of catalin, lucite, plexiglas and acetate is available on request, as are samples, from Ace Plastic Company, 91-30 Van Wyck Blvd., Jamaica 1, N. Y.

FINISHING & COATING

Henry W. Harding, president of the Stewart Hartshorn Company, window shade manufacturer, called a meeting of all branch managers and regional directors to discuss the expansion program and the contribution to the mobilization program. The company is adequately equipped to participate in this program. Its Oswego Mill is equipped to bleach, dye, finish, and coat textiles, including canvas. The finishing and coating processes employed at Oswego include emulsion, solution, platisol and organosol.

PLASTIC ENVELOPES

A new, improved type of job-ticket envelope is now available through American Kleer-Vu Plastics, Inc., Brooklyn 6, N. Y. This heavy duty envelope is available in non-inflammable, .005 or .0075 gauge all-new cellulose acetate. Edges are protected with pyroxilin tape, strongly sewn all around, for extra utility. Known as the KV1, the envelope measures 12" x $10\frac{1}{2}$", (outside dimension), and is especially useful for reducing errors in production while protecting work orders, blueprints and shop cards from grease and grime. It may also be used for guarding sales literature, photos and office records from general wear and tear. The KV1 is the company's basic factory-type envelope. Strap hangers, grommets and special backings can be added at small additional expense. For more information and a free sample of the KV1, write: Dept. P, American Kleer-Vu Plastics, Inc., 58 Thames Street, Brooklyn 6, N. Y.

CLEANSER

The Chemical Rubber Co., 2310 Superior Ave., Cleveland 14, Ohio has recently announced that they are able to supply any quantity of C.R.C. Cleanser that is needed. Since it contains no soap, it does not form insoluble soaps when used with hard water. Its use in the plant, office or home have proven effective and economical.

MEMO PAD

The Victory Manufacturing Co. have recently brought out a handy Memo Pad and Pen Holder molded in antique white, dubonnet or walnut plastic, which comes with an initial supply of memo paper and an unusual mechanical pencil and ball-point pen combination.

PLASKON ALKYD

Plaskon Alkyd is gaining wide usage by the electrical equipment manufacturing industry. Commercial and residential watt-hour meter mountings have been molded by Blakeman Brothers Electric Mfg. Co., of Los Angeles. The Central Div. of Globe-Union, Inc., in Milwaukee have used it for high voltage capacitors for television sets. Bulletins A-3, A-4 and A-7, the first section of a technical handbook on Plaskon Alkyd Molding Compound, provide a description of the compounds advantages and benefits.

DUREZ NEWS

The "Durez Plastics News" carries many interesting notes on product improvements that can be made with the use of Durez compounds. You may be placed on the mailing list to receive this monthly bulletin by requesting it from Durez Plastics & Chemicals, Inc., 1310 Walck Rd., North Tonawanda, N. Y.

MARINE MAGNESIUM

Whittaker, Clark & Daniels, Inc., 260 West Broadway, New York 13, New York, continue to distribute marine magnesium products: magnesium carbonate, magnesium oxide, magnesium hydroxide under the trademark names of Maglite and Hydro-Magma for the new Marine Magnesium Products Division of Merck & Co., Inc.

ACCOUNTANTS TO VIEW FILM TO STUDY PLASTICS INDUSTRY

The plastics industry and its accounting problems were studied through a new technique combining the use of film and group discussion at two meetings held in April by the New York Chapter of the National Association of Cost Accountants.

To acquaint themselves with the plastics industry's products and manufacturing methods, the accountants attended a film showing on April 3. Ie included "The Shape of Things to Come," in color, produced by the Boonton Molding Company.

On the basis of their understanding of the industry's problems gained from the films, the accountants met again on April 10 to discuss cost control in the industry. William H. Nussbaum, CPA, 17 Ames Ave., Rutherford, N. J., who has served the plastics industry as an accountant and auditor, spoke at this meeting.

Both the film showing and the discussion session were held in the National Cash Register auditorium, 50 Rockefeller Plaza, starting at 7 p.m.

BAKELITE FELLOWSHIP

Establishment by the Bakelite Division, Union Carbide and Carbon Corporation, of a Bakelite Fellowship in plastics at Princeton University was announced here today by Professor Louis F. Rahm, Director of the Plastics Laboratory. The recipient will do graduate work next year.

"As a tribute to Princeton's pioneering effort in plastics engineering education such generous help is indeed appreciated," Professor Rahm said. "It provides support for fundamental research in this broad field and the means for training good men for the industry."

THREE SPEAKERS TALK AT NEWARK

EDUCATION PROGRAM HEADED BY RUSS AKIN

By Anthony Naturale

The regular monthly meeting of the Newark Chapter of the Society of the Plastics Engineers was held on Wednesday, March 14, 1951.

The New York Chapter members who crossed the river to attend our meeting were well rewarded in viewing a large plastic display and listening to the talks given by Mr. Willard De Camp Crater, Mr. George Vila and Dr. Earle S. Ebers of the Naugatuck Chemical Division, U. S. Rubber Company.

Our President, Mr. Pete W. Simmons, of Dow Chemical Company informed the members of the Board of Directors decision to inaugurate an educational program. The Committee will be headed by Mr. Russell Akin of E. I. du Pont de Nemours, Co., Inc. The purpose of this program will be to help college students, who are interested in plastics, obtain more information about the plastics industry.

Mr. Pete W. Simmons also announced the Golf Outing planned by the Newark Chapter for June, 1951. An invitation will be extended to the New York Chapter of the Society of the Plastics Engineers and the members of the Plastics Engineers Association. Mr. Kirby Preston of Koppers, Inc. and Mr. Wally Gryce of Newark Die Company will be co-chairmen of a committee to make the arrangements for the Golf Outing.

Mr. George Vila of Naugatuck Chemical Division, U. S. Rubber Company gave a talk on the history of Naugatuck Chemical Division and the relation the rubber industry has to the plastic industry. He pointed out that the rubber industry was making polystyrene in 1936.

The next man to take the Speakers Platform was Dr. Earle S. Ebers also of Naugatuck Chemical Division, U. S. Rubber Company. Dr. Ebers gave an interesting talk on Royalite, Uscalite, Kralastic and Enrup. In his discussion he reviewed how quality played the most important role in the development of the four materials. The first one, Royalite is available in sheet stock and can be very easily formed. This characteristic was demonstrated by Dr. Ebers.

As for Uscalite, it is very similiar in specifications to Royalite except that it can be extruded or molded. Kralastic, a molding powder offered early in 1950, was readily acceptable. It is better than Uscalite for flow and molding characteristics.

Enrup is not in the same class as the other three previously mentioned. It is moldable and can be obtained in different hardness varying from soft to very hard.

Dr. Ebers also discussed the characteristics of the Polyester Resins Vibrins. This material can be converted from a fluid to a solid in a few seconds. In a demonstration Dr. Ebers proved this by adding a catalyst to the resin. This material also, has a hardness range that varies from flexible to brittle.

The rigid vinyl field was covered very well by Willard De Camp Crater of Naugatuck Chemical Division, U. S. Rubber Company. Mr. Crater held a question and answer period which finally brought the meeting to a close.

New members announced at this meeting were: Theodore J. Kerekes, Jack Dubman, Benjamin W. Walker, Henry F. Colvin, Edward V. Michal, Thomas F. Rogers, William B. Bradbury, Clare Glander, Walker R. Yaroshuk, Coleman P. Morgan.

NEW YORK

By A. M. Merrill

The March 14 meeting of the New York Section was the annual joint dinner meeting with the Newark Section at the Military Park Hotel, Newark. The program featured a panel discussion on Royalite, Uscolite, Kralastic, Enrup, Vibrin, and Marvinol by George R. Vila, Earle S. Ebers, and Willard de C. Crater, all of Naugatuck Chemical Division, United States Rubber Co.

The next regular dinner meeting of the New York Section was held on April 18 at the Hotel Shelburne. Speaker of the evening was Dr. Lucius Gilman, Pickatinny Arsenal, who discussed "Handling Plastic Problems in the Ordnance Corps."

Three new members have been added by the Section during March, as follows: William M. Shine, sales development, Arnold, Hoffman & Co., Inc.; Ralph M. Verni, molding room foreman, Jamison Plastic Corp.; and Robert A. Woodard, sales and service manager, Catalin Corp. of America.

MIAMI VALLEY HEARS MORSE

By John L. Russell

Miami Valley Section members met on Thursday, April 5 at Hamilton, O., for a session that was postponed from February 1 due to heavy snow and extreme cold weather. It featured a talk by A. R. (Ren) Morse, "Production Aids for the Injection Molders". Ralph Backscheider, Recto Molded Products, Inc. Cincinnati, O. is Program Chairman.

Martin Kasch, President of Miami Valley Section presided. Mr. Morse is well known in the plastics world having been associated with the Reed-Prentice Corp. for ten years and is now president of the Injection Molders Supply Co., Cleveland, O. He was the winner of the second SPE National Prize Paper Contest, co-author of another and is now editor of the Injection Molderscope column which appears monthly in the SPE Journal. His talk will command great interest to the injection molders in the Dayton-Cincinnati area.

A transfer notice advises us officially that David Hawk, formerly with the Belden Mfg. Co., Richmond, Ind., and a Miami Valley Section member, is now connected with the B. F. Goodrich Co. in Avon Lake, Ohio, and has been transferred to the Cleveland-Akron Section. Paul Bury, formerly with the Drackett Co., Cincinnati and a Miami Valley Section Member, has been transferred to the Upper Mid-West Section.

FOR TEN YEARS

MISKELLA DRYERS AND PREHEATERS

HAVE BEEN

Manufactured by

THE MISKELLA *Infra-Red* COMPANY

MAIN OFFICE 7302 GRAND AVE., CLEVELAND 4, OHIO

TORONTO SETS UP SPECIAL BOARD TO ASSIST THE DEFENSE EFFORT

By J. N. Kempf

Toronto's dinner meeting held in the main dining room of the Walker House Hotel, the evening of March 20th featured Mr. W. D. Smith, Technical Director, Canadian Resins and Chemicals Ltd., Shawinigan Falls, Quebec, as the guest speaker. Mr. Smith was introduced by Mr. George M. Hale, District Representative for Canadian Resins and a member of the Toronto Section. Mr. Smith gave a lengthy and informative address on the subject of "Processing the Vinyls."

The Toronto Section enjoyed a record attendance of 63 members and guests at this meeting. Mr. Smith's illustrated discussion was followed by a lively question and answer period, which, combined with the large sample display, aroused a great deal of interest among those present.

Four members of the Toronto Section will be attending, by invitation, the preliminary National Council Committee meeting in Ottawa on March 28th concerning melamine tableware for the armed services. The Toronto Section members attending this meeting will be Messrs. W. C. Lacroix, Professional Activities Chairman, F. W. McEwen, Secretary, J. F. Schneider, Treasurer and B. Kellam. Mr. Wilf Lynch, Vice President of the Toronto Section is assisting Bill Lacroix in setting up his special Technical Board which will include a cross section of the Toronto membership in each phase of plastics processing e.g. Research, Mold Design, Tooling, Injection and Compression Molding, Extrusion, Fabricating, Low and High Pressure Laminating, etc. Mr. Lynch informed the members and guests at our last dinner meeting concerning the formation of this special committee and the purpose it would endeavor to serve in assisting with the proper specifications and applications of plastic materials in defense and armed service's equipment. Comments and participation by members and non-members alike were invited with good response. This committee when fully organized will stand ready to be of assistance when required. It is also worthy of note that in this effort the Toronto Section of SPE is cooperating with a similar committee composed largely of members of the Society of the Plastics Industry (Toronto Chapter). Further details concerning the progress of this group will be forthcoming.

MONEY FREE AT GOLDEN GATE

By R. M. Weber

The Golden Gate Section met on February 28th at El Jardin Restaurant. Mr. C. I. Spessard of Bakelite Division, Union Carbide & Carbon spoke on "Plastisols and Organisols." His talk was illustrated with slides and varied assortment of samples and products in which the above chemical tools play a major part.

A short discussion was held on the floor during which those present reviewed and analyzed our work in the SPE and especially in regard to maintaining membership and improving attendance at the meetings. Those present for this meeting numbered 22.

The Golden Gate March meeting was called to order at 6:50 P.M., by Pres. Joseph Smith presiding with all officers present excepting Treasurer Leonard Faber who was ill.

The place of gathering was the members favorite, El Jardin, 26 California St.

After fragmentizing a steak dinner which had been pre-heated, the members devoted the polymerization period to a talk by Mr. Jack Leyden of the Crucible Steel Co. Mr. Leyden's subject was: "Types of Steels Used In the Plastics Industry."

A question and answer period followed the talk in which many of the members took part. Judging by the favorable comments Mr. Leyden's efforts were well received.

It was announced on the floor that beginning with the present officers' term of office each S.P.E.'er would be given a check on entering the meeting hall. At the end of the year a drawing will be made with the following prizes given out:

1st. $75.00, 2nd. $25.00, 3rd. $10.00.

The more meetings attended, the better one's chances are. The purpose of the move is to improve attendance.

After the business of the evening, which adjourned at 9:15, the officers had a pow wow concerning future activities. It was there deemed wise to make the June meet a **social** affair for men and their wives (or surrogates) because of the disruption to organizational affairs due to vacations.

ADHESIVES TOPIC AT MIDWEST

By D. H. Chambers

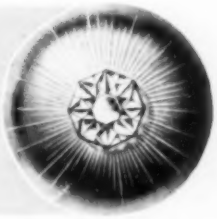
On March 12, Mr. Gordon Hollingsworth, Manager, Technical Service, Adhesives and Coatings Division, Minnesota Mining & Manufacturing Co., Detroit, Michigan, spoke on "Adhesives in New Product Development." Mr. Hollingsworth discussed the importance of design where adhesives are to be used. Applications were presented, such as bonding plastics to metal and also bonding wood to metal. He also illustrated his talk with exhibits and charts.

It was announced that for the April Meeting, Mr. Brook Stevens, internationally famous Industrial Designer, will speak on "Industrial Designers Part in Product Design and Plastics."

Always specify...

R&J PLASTICS GRINDERS

with cap. of 50 to 3,000 pounds per hour



BALL & JEWELL, INC.

20 Franklin Street, Brooklyn 22, New York

JOURNAL

Official Publication of The Society of Plastics Engineers, Inc. 409 Security Bank Building, Athens, Ohio.

POSTMASTER. Forwarding and Return Postage Guaranteed.

University of Michigan
General Library O#L 71033
Ann Arbor, Michigan

Your name and address as listed above is the way it will appear in the June membership roster. Please notify editor of any changes or corrections.

Vacuum Molding

(Continued from page 6)

wood or modeled out of clay, or it can be one of the little ten cent store cars on the market today. For the first attempt select one which has smooth flowing curves and no sharp corners or undercuts which can give trouble. Coat it lightly with vaseline as a parting agent and make a plaster mold of it. After drilling the vacuum holes in the mold cavity, connect the mold to the vacuum reservoir, close the air valve and evacuate the reservoir tank by running water through the aspirator.

To give the automobile body some rigidity, plastic no thinner than 1/16" should be used and 3/32" thick would be better. In general Lucite or Plexiglas should be heated to about 330F-350F before drawing. This is hotter than ordinary bending and forming temperatures but the plastic has to be absolutely soft in order that it be vacuum formed. Drape the sheet over the mold and hold it down tightly with gloved hands so as to form an air tight seal around the mold cavity and permit the cavity to be evacuated. When the vacuum in the reservoir tank registers 25 to 30 inches of mercury on the gage, open the air valve and the plastic will be sucked down into the cavity.

After a few minutes the plastic will be cool enough to remove. Trim off the excess material with a jig saw or coping saw and sand the edges smooth. Drill four holes with a 1/16" drill bit in the sides where the axles will be. The axles are orange sticks of the type sold by ten cent stores to make frozen suckers. Cut these off to the proper length and force two fiber washers on each axle to make the wheels. Drill two 1/16" holes in the ends of the orange sticks to accommodate the #17 wire brads which hold the axles on to the body of the car and the project is complete (see Figure 4.)

The ABC in Plastic Molds means
AMERICA'S BEST CASTINGS—
Fabricated exclusively by Manco
in BERYLLIUM COPPER
* * * * * * *
QUALITY is not an accident at MANCO!
—Prompt Delivery—
—No increase in price—
Write for our new Brochure
BERYLLIUM COPPER
AT ITS BEST
TRU-CAST BY MANCO
MANCO PRODUCTS CO.
2101-2109 SCHAEFER ROAD
MELVINDALE ● MICHIGAN

Section Notes

Saint Louis

The Saint Louis Section met on March 27, to hear Mr. Frank Hale, Sales Engineer of Keller Machine Division, Pratt & Whitney, West Hartford, Conn., discuss "Keller Machines in Plastic Mold Industry". The meeting was well attended and a tremendous interest was shown. Membership Chairman, C. Todd Clark, is offering "A Manual on Plastics and Resins" edited by William Schack as an attendance prize.

Buffalo

Norman E. Wahl, Plastics Engineer, Cornell Aeronautical Laboratory, discussed "Development of Laminated Plastic Rotor Blades for Helicopters" at the March 16 meeting of the Buffalo Section. Two reels of pictures were shown and the lecture was followed by a discussion period. Mr. Wahl is a former president of the Buffalo Section and has carried on active research work in plastics at Cornell Aeronautical Laboratory for several years.

Quebec

The Quebec Section met for dinner in the Venus de Milo Room of the Venus Grill on March 28th. After which they went to the C. I. L. Amphitheater to hear Mr. S. R. Melvin of Monsanto Chemical Co. discuss "Improvement of Thermoplastic Products by Post Molding Treatments". The address outlined operations such as annealing, plating and decorating of injection molded parts and was illustrated by slides and samples.

Philadelphia

The Philadelphia SPE & SPI Section met on March 27th at the Franklin Institute to hear Mr. R. W. Van Sickle of Dow Chemical Company's Plastics Technical Service. He discussed and illustrated with slides general mold design and restricted gating. He used the unusual film of a molding operation using a transparent cavity which showed the flow of the material under pressure.

Rochester

The Rochester Section met at the Clintonaire Restaurant on March 19 to hear S. R. Melvin of Monsanto Chemical Company discuss "Improvement of Thermoplastic Products by Post Molding Treatments". Twenty-four members attended the meeting and entered into the discussion period which followed the interesting and informative talk. Mr. Richard Hayes won the door prize.

Metallizing Plastics Is Chicago Topic

By Tim Serrell

"Metallizing of Plastics" was the subject of Mr. Tom Comer's (Distillation Products Industries) talk before the regular monthly joint meeting of the SPE and SPI held at the usual meeting room in the Builder's Club, 228 North La Salle Street, Chicago, Illinois, March 14, 1951. The talk, accompanied by slides, was well attended and was followed by an informal question and answer period.

Mr. Lee Swift, President of the Chicago Chapter of the Society of Plastic Engineers, announced that Tim Serrell, Bakelite Company, Division of Union Carbide & Carbon Corporation, had been appointed Chairman of the Publicity Committee for 1951.

Ben Rau of G. Felsenthal & Sons presented a report on all plastic raw materials.

Members and guests attended in such large numbers that the dining room was filled beyond capacity.

THE LAWHEAD PRESS, INC., ATHENS, OHIO